# Chapter 2
# Data Collection

**Chapter Contents**



This chapter contains information used to evaluate the health, environmental and regulatory concerns associated with the individual chemicals found in the lithographic blanket washes, and discusses how this information was obtained. Section 2.1 addresses the organization of the 56 specific chemicals that compose the blanket washes into generic chemical categories. Section 2.2 includes information on the physical and chemical properties of each specific chemical. Melting point, vapor pressure and the bioconcentration factor are among the many properties detailed in this section. Section 2.3 presents known human health toxicological data for each chemical. Information on the exposure routes, toxicity endpoints (such as carcinogenicity, developmental toxicity and neurologic effects), and exposure levels of concern for the chemicals are included in this section. Section 2.4 contains environmental effects data for each of the 56 chemicals. Included here is information on the chemical's acute and chronic aquatic toxicity levels for fish, invertebrates and algae, and an environmental hazard ranking for each chemical. Section 2.5 identifies which of the specific chemicals are subject to federal environmental regulations and describes each of the regulations that apply. The focus in Section 2.6 shifts from specific chemicals to the actual blanket wash formulations submitted by suppliers. In this section, safety hazard classifications for reactivity, flammability, ignitability and corrosivity have been assigned to each of the blanket washes.

## 2.1 CATEGORIZATION OF BLANKET WASH CHEMICALS FOR GENERICIZING FORMULATIONS

The chemical formulations of commercial products containing distinct chemical mixtures are frequently considered proprietary. Manufacturers of these products typically prefer not to reveal their chemical formulations because a competitor can potentially use the disclosed formulation to sell the product, often at a lower price, since the competitor did not have to invest in research and development. In addition, the performance of products may vary depending on use and shop conditions, and suppliers were concerned about the characterization of the performance of their products. The EPA was concerned about appearing to endorse brand name products that fared well in the CTSA evaluation. Due to these concerns, the Lithography Project partners developed a system to genericize the blanket wash formulations discussed in the CTSA.

In order to participate in the Project, each supplier was required to submit their product and its exact formulation to Printing Industries of America (PIA), who replaced the product brand name with a blanket wash number. The EPA completed the risk characterization using the exact formulations but without knowledge of the supplier or the brand name. The numbering system assigned by PIA is used throughout the CTSA. In addition, to maintain the confidentiality of the formulations, the CTSA reports the results using the categorization system shown below in Table

2-1. Each chemical in the blanket wash formulations was grouped into a category and the categories are used to report the results (i.e., estimated environmental release) for each formulation. The percentages of each component in a given formulation are not listed. If a printer wishes to determine the manufacturer who produces a given formulation, a list of participating manufacturers appears in the front of the document. Each participating manufacturer is aware of his or her assigned product number as well as their genericized formulation.

**Table 2-1. Categorization of Blanket Wash Chemicals**

| Category | Chemicals from Blanket Wash Use Cluster in Category |
|---|---|
| Alkali/salts | Sodium Hydroxide;<br>Tetrapotassium pyrophosphate;<br>Ethylenediaminetetraacetic acid, tetrasodium salt |
| Alkanolamines | Diethanolamine |
| Alkoxylated alcohols | Alcohols, $C_{12}$-$C_{15}$ , ethoxylated;<br>Oxirane, methyl, polymer with oxirane, monodecyl ether;<br>Polyethoxylated isodecyloxypropylamine;<br>Poly(oxy-1,2-ethanediyl), α-hexyl-ω-hydroxy-;<br>Sorbitan, monododecanoate, poly(oxy-1,2-ethanediyl) derivatives |
| Alkyl benzene sulfonates | Benzenesulfonic acid, dodecyl-;<br>Benzenesulfonic acid, dodecyl-, compounds with 2-aminoethanol;<br>Benzenesulfonic acid, dodecyl-, compounds with 2-propanamine;<br>Benzenesulfonic acid, (tetrapropenyl)-, compounds with 2-propanamine;<br>Benzenesulfonic acid, $C_{10}$-$C_{16}$-alkyl derivatives, compounds with 2-propanamine;<br>Sodium xylene sulfonate |
| Dibasic esters | Dimethyl adipate;<br>Dimethyl glutarate;<br>Dimethyl succinate; |
| Ethylene glycol ethers | Diethylene glycol monobutyl ether |
| Ethoxylated nonylphenol | Ethoxylated nonylphenol |
| Fatty acid derivatives | Fatty acids, $C_{16}$-$C_{18}$, methyl esters;<br>Fatty acids, $C_{16}$-$C_{18}$ and $C_{18}$-unsatd, compounds with diethanolamine;<br>Sorbitan, mono-9-octadecanoate;<br>Sorbitan, monolaurate;<br>Soybean oil, methyl ester;<br>Soybean oil, polymerized, oxidized;<br>Tall oil, special;<br>Fatty acids, tall oil, compounds with diethanolamine |
| Glycols | Propylene glycol |

| Category | Chemicals from Blanket Wash Use Cluster in Category |
|---|---|
| Hydrocarbons, aromatic | Benzene, 1, 2, 4-trimethyl-;<br>Cumene;<br>Solvent naphtha (petroleum), heavy aromatic;<br>Solvent naphtha (petroleum), light aromatic;<br>Xylene |
| Hydrocarbons, petroleum distillates | Distillates (petroleum), hydrotreated middle;<br>Mineral spirits (light hydrotreated);<br>Naphtha (petroleum), hydrotreated heavy;<br>Solvent naphtha (petroleum), light aliphatic (VM&P Naphtha);<br>Solvent naphtha (petroleum), medium aliphatic;<br>Stoddard solvent |
| Esters/lactones | Butyrolactone;<br>Propanoic acid, 3-ethoxy-, ethyl ester;<br>Sodium bis(ethylhexyl) sulfosuccinate;<br>Sorbitan tri-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivatives |
| Nitrogen heterocyclics | N-methyl pyrrolidone |
| Propylene glycol ethers | Dipropylene glycol monobutyl ether;<br>Dipropylene glycol methyl ether;<br>Propylene glycol monobutyl ether; |
| Terpenes | Hydrocarbons, terpene processing by-products;<br>*d*-Limonene;<br>Linalool;<br>Nerol;<br>2-Pinanol;<br>Plinols;<br>α-Terpineol;<br>Terpinolene; |

## 2.2 CHEMICAL INFORMATION

This section discusses the physical nature of the 56 specific chemicals used in blanket wash formulations. First, there is a description of the types of information that are provided for each chemical, including a glossary of chemical properties terms presented in Table 2-2. This includes their chemical and physical properties, safety hazard factors, and environmental fate. Following these descriptions, Table 2-3 lists the name, Chemical Abstracts Service (CAS) Registry Number, and common synonyms for each of the chemicals. The chemical and physical properties and safety hazard factors are then listed in the Chemical Properties and Information summary for each chemical.

### 2.2.1 Chemical Properties and Information

For each blanket wash chemical, there is a corresponding Chemical Properties and Information summary. All of the information in these summaries, except for the Safety Hazard Factors, was obtained by searching standard references, listed at the end of this chapter. This summary contains information on the following chemical and physical properties:

**Table 2-2. Glossary of Chemical Properties Terms**

| Term | Definition |
|---|---|
| Chemical Abstracts Service Registry Number (CAS #) | A unique identification code, up to ten digits long, assigned to each chemical registered by the Chemical Abstract Service. The CAS # is useful when searching for information on a chemical with more than one name. |
| Synonyms | Alternative names commonly used for the chemical. |
| Molecular weight | A summation of the individual atomic weights based on the numbers and kinds of atoms present in a molecule of a chemical substance. For polymers, this may include molecular weight distributions, ranges, and averages. Typical unit is g/mole. |
| Melting point | The temperature at which a substance changes from the solid to the liquid state. It indicates at what temperature solid substances liquify. Typical unit is °C. |
| Water solubility | The maximum amount of a chemical that can be dissolved in a given amount of pure water at standard conditions of temperature and pressure. Typical unit is g/L. |
| Vapor pressure | The pressure exerted by a chemical in the vapor phase in equilibrium with its solid or liquid forms. It provides an indication of the relative tendency of a substance to volatilize. Typical unit is mm Hg. |
| Octanol-water partition coefficient ($Log_{10}K_{ow}$) | Provides a measure of the extent of a chemical partitioning between water and octanol (as a surrogate for lipids or other organics) at equilibrium. It is an important parameter because it provides an indication of a chemical's water solubility and its propensity to bioconcentrate in aquatic organisms or sorb to soil and sediment. |
| Soil sorption coefficient ($Log_{10}K_{oc}$) | Provides a measure of the extent of chemical partitioning between the solid and solution phases of a two-phase system, especially soil, sediment or activated sludge. Usually expressed on an organic carbon basis, as the equilibrium ratio of the amount of chemical sorbed per unit weight of organic carbon in the soil, sediment or sludge to the concentration of the chemical in solution. The higher the $K_{oc}$, the more likely a chemical is to bind to soil or sediment than to remain in water. |
| Bioconcentration factor ($Log_{10}$ BCF) | Provides a measure of the extent of chemical partitioning at equilibrium between a biological medium such as fish tissue or plant tissue and an external medium such as water. The higher the BCF, the greater the accumulation in living tissue is likely to be. |
| Henry's Law Constant | Provides a measure of the extent of chemical partitioning between air and water at equilibrium; estimated by dividing the vapor pressure of a sparingly water soluble chemical substance by its water solubility. The higher the Henry's Law constant, the more likely a chemical is to volatilize than to remain in water. |
| Publicly Owned Treatment Works (POTW) overall removal rate | The extent to which a chemical substance is removed from influent wastewater by typical POTWs employing activated sludge secondary treatment. Expressed as 100 minus that percentage of the material originally present that remains in the liquid effluent after treatment. |
| Chemistry of use | The primary use of the chemical in the lithographic printing industry. |

| | |
|---|---|
| Molecular formula and physical structure of the chemical | A description of the number and type of each atom in the chemical and a description of how the atoms are arranged and the types of bonds between atoms. |
| Boiling point | The temperature at which a liquid under standard atmospheric pressure (or other specified pressure) changes from a liquid to a gaseous state. It is an indication of the volatility of a substance. The distillation range in a separation process, the temperature at which the more volatile liquid of a mixture forms a vapor, is used for mixtures in the absence of a boiling point. Typical unit is °C. |
| Density | The mass of a liquid, solid, or gas per unit volume of that substance, i.e., the mass in grams contained in 1 cubic centimeter of a substance at 20°C and 1 atmosphere pressure. Typical unit is $g/cm^3$. |
| Flash point | The minimum temperature at which a liquid gives off sufficient vapor to form an ignitible mixture with air near the surface of the liquid or within the test vessel used. |
| Safety hazard factors | Discussed in detail below. |

Any of the property values acquired from the standard references have been designated as measured (M), since the data in these sources have been experimentally determined for the specific chemical in question. (Please note that synonyms, molecular weight, chemistry of use, and structure have no such designation since these are not values that can be measured, but rather are attributes intrinsic to the chemical in question.)

For some chemicals there was little or no information in the standard references and significant data gaps existed. Therefore, the values for the physical and chemical properties of these chemicals needed to be estimated. These estimations were obtained using several programs accessed through the Estimation Programs Interface (EPI), available from Syracuse Research Corporation. EPI uses the structure of the chemical for input to eight chemical property estimation programs. The programs used to complete the individual Chemical Properties and Information summaries are as follows:

- Octanol-Water Partition Coefficient Program (LOGKOW). (Meylan WM and PH Howard. 1995. Atom/fragment contribution method for estimating octanol-water partition coefficients. J. Pharm. Sci. 84: 83-92.)

- Henry's Law Constant Program (HENRY). (Meylan WM and PH Howard. 1991. Bond contribution method for estimating Henry's Law constants. Environ. Toxicol. Chem. 10:1283-1293.)

- Soil Sorption Coefficient Program (PCKOC). (Meylan WM, PH Howard and RS Boethling. 1992. Molecular topology/fragment contribution method for predicting soil sorption coefficients. Environ. Sci. Technol. 26:1560-1567.)

- Melting Point, Boiling Point, Vapor Pressure Estimation Program (MPBPVP).

- Water Solubility Estimation Program (WSKOW). (Meylan WM, PH Howard and RS Boethling. 1996. Improved method for estimating water solubility from octanol/water coefficient. Environ Toxicol. Chem. 15(2):100-106.)

- Sewage Treatment Plant Model (STP), a fugacity model for estimating the efficiency of pollutant removal. (Clark B, JG Henry and D Mackay. 1995. Fugacity analysis and model of organic chemical fate in a sewage treatment plant. Environ. Sci. Technol. 29:1488-1494.)

The accuracy of these programs has not been established in all cases, but the listed programs are considered to be the best methods currently available. In addition to the journal articles discussing the development and use of these programs found at the end of this section (with the exception of the MPBPVP program), a user's guide also is available for the EPI and each program. Any property values determined using these programs have been designated as estimated (E). It should be noted that the water solubility estimation program has an anticipated margin of error of plus or minus one order of magnitude. The LOGKOW is expected to be accurate to 0.1 log units for most compounds, although the PCKOC is likely to be somewhat less accurate due to the complex nature of the soil/sediment sorption phenomena.

For several chemicals, no data were available in any of the primary sources, and EPI estimation methods were not performed because the complex nature of the chemical (e.g., chemicals with ranges of carbon atoms) skewed the estimation results. For these chemicals, chemical and physical data had to be estimated based on structure-activity relationships (i.e., comparison with analogous chemicals with known properties). In addition, some properties were estimated from best chemical judgment based on the class of compounds to which the chemical in question belongs. For example, chemical and physical property values for benzenesulfonic acid, dodecyl-, compounds with 2-aminoethanol have been estimated based on similarities with the other benzenesulfonic dodecyl- blanket wash chemicals. Any property values determined by this comparison method have been designated by an (E), estimated. Any chemical and physical property values that still could not be estimated have been designated as not available.

### 2.2.2 Safety Hazard Factors

In addition to the physical and chemical properties of a chemical discussed above, there are other chemical attributes that are important for the handling, use and storage of a chemical in the workplace. These attributes have been designated as Safety Hazard Factors and they include chemical reactivity, flammability, ignitability and corrosivity. Information used to determine the Safety Hazard Factors was taken from the following sources (if information was not available for particular factor it was not included in the Chemical Properties and Information summary):

- National Fire Protection Association's (NFPA) Fire Protection Guide to Hazardous Materials (10th edition), Quincy, Massachusetts.

- 40 CFR §261.20 (Protection of Environment, RCRA, Identification and Listing of Hazardous Waste), Characteristic of Ignitability.

- Department of Transportation's Hazardous Materials Table 49 CFR §172.101.

The reactivity and flammability values are taken from the National Fire Protection Association's (NFPA) Fire Protection Guide to Hazardous Materials (10th edition). For reactivity, materials are ranked on a scale of 0 through 4:

0 - materials that are normally stable, even under fire exposure conditions, and that do not react with water; normal fire fighting procedures may be used.

1 - materials that are normally stable, but may become unstable at elevated temperatures and pressures and materials that will react with water with some

release of energy, but not violently; fires involving these materials should be approached with caution.

2 - materials that are normally unstable and readily undergo violent chemical change, but are not capable of detonation; this includes materials that can rapidly release energy, materials that can undergo violent chemical changes at high temperatures and pressures, and materials that react violently with water. In advanced or massive fires involving these materials, fire fighting should be done from a safe distance of from a protected location.

3 - materials that, in themselves, are capable of detonation, explosive decomposition, or explosive reaction, but require a strong initiating source or heating under confinement; fires involving these materials should be fought from a protected location.

4 - materials that, in themselves, are readily capable of detonation, explosive decomposition, or explosive reaction at normal temperatures and pressures. If a material having this Reactivity Hazard Rating is involved in a fire, the area should be immediately evacuated.

For flammability, materials are ranked on a scale of 0 through 4:

0 - any material that will not burn.

1 - materials that must be preheated before ignition will occur and whose flash point exceeds 200°F (93.4°C), as well as most ordinary combustible materials.

2 - materials that must be moderately heated before ignition will occur and that readily give off ignitible vapors.

3 - flammable liquids and materials that can be easily ignited under almost all normal temperature conditions. Water may be ineffective in controlling or extinguishing fires in such materials.

4 - includes flammable gases, pyrophoric liquids, and flammable liquids. The preferred method of fire attack is to stop the flow of material or to protect exposures while allowing the fire to burn itself out.

Chemicals not ranked by NFPA were not assigned a reactivity or a flammability value.

For ignitability, the blanket wash chemicals have been classified as either ignitable "Y", or not ignitable "N". The determination of ignitability is based upon the standard outlined in 40 CFR §261.20 (Protection of Environment, RCRA; Identification and Listing of Hazardous Waste), Characteristic of Ignitability. Under this standard, a chemical is considered ignitable if it "is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume and has a flash point less than 60°C (140°F) as determined by a Pensky-Martens Closed Cup Tester...a Setaflash Closed Cup Tester...or an equivalent test method." The flash points for these chemicals were taken from the NFPA Fire Protection Guide to Hazardous Materials, and if no flash point existed for a chemical, no ignitability designation was assigned.

For corrosivity, the blanket wash chemicals have been categorized as either corrosive or not corrosive. Any chemical with a designation in the corrosivity column is listed in the Department of Transportation's Hazardous Materials Table in 49 CFR §172.101. This table lists all required labels a chemical must have affixed to its container prior to shipping. Chemicals

which require a corrosive shipping label have been designated by "Y", while chemicals which do not require this label have been designated by "N". Chemicals not listed in the DOT Hazardous Materials Table have not been assigned a corrosivity designation.

### 2.2.3 Chemical Properties and Information Summaries

In Table 2-3, each of the 56 blanket wash chemicals are listed along with their common synonyms and the Chemical Abstracts Service Registry Number. Immediately following the table are the individual Chemical Properties and Information summaries for each chemical.

**Table 2-3. Chemicals in Blanket Wash Formulations**

| Chemical Name | CAS Number | Synonym |
|---|---|---|
| Alcohols, $C_{12}$-$C_{15}$, ethoxylated[c] | 68131-39-5 | EMUL/Mix[b] |
| Benzene, 1,2,4-trimethyl- | 95-63-6 | Pseudocumene |
| Benzenesulfonic acid, dodecyl-[c] | 27176-87-0 | Dodecyl benzene sulfonic acid[b] |
| Benzenesulfonic acid, dodecyl-, compounds with 2-aminoethanol | 26836-07-7 | Dodecylbenzenesulfonic acid, ethanolamine salt |
| Benzenesulfonic acid, dodecyl-, compounds with 2-propanamine[c] | 26264-05-1 | Isopropylamine salt of dodecylbenzenesulfonic acid[b] |
| Benzenesulfonic acid, (tetrapropenyl)-, compounds with 2-propanamine | 157966-96-6 | Isopropylamine salt of (tetrapropenyl) benzenesulfonic acid |
| Benzenesulfonic acid, $C_{10}$-$C_{16}$- alkyl derivatives, compounds with 2-propanamine[c] | 68584-24-7 | Benzenesulfonic acid, $C_{10}$-$C_{16}$- alkyl derivatives, compounds with isopropylamine |
| Butyrolactone | 96-48-0 | 2(3H)-Furanone, dihydro[b] |
| Cumene[a] | 98-82-8 | Benzene, (1-methylethyl)-[b] |
| Diethanolamine[a] | 111-42-2 | Ethanol, 2,2'-iminobis-[b] |
| Diethylene glycol monobutyl ether | 112-34-5 | Ethanol, 2-(2-butoxyethoxy)-[b] |
| Dimethyl adipate | 627-93-0 | Dimethyl hexanedioate; methyl adipate; dimethyl ester adipic acid |
| Dimethyl glutarate | 1119-40-0 | Glutaric acid, dimethyl ester; pentanedioic acid, dimethyl ester |
| Dimethyl succinate | 106-65-0 | Succinic acid, dimethyl ester; butanedioic acid, dimethyl ester; methyl succinate |
| Dipropylene glycol monobutyl ether | 29911-28-2 | 2-Propanol, 1-(2-butoxy-1-methylethoxy)-[b]<br>DGMBE |
| Dipropylene glycol methyl ether | 34590-94-8 | DPGME |
| Distillates (petroleum), hydrotreated middle[c] | 64742-46-7 | Hydrotreated middle distillate[b] |

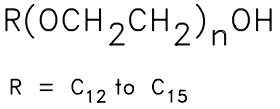
| Chemical Name | CAS Number | Synonym |
|---|---|---|
| Ethoxylated nonylphenol | 9016-45-9<br>26027-38-3<br>68412-54-4 | Ethoxylated nonylphenol[b], α-(nonylphenyl)-ω-hydroxy-, branched and unbranched isomers[c]; NP-6[b]; NP-9[b] |
| Ethylenediaminetetraacetic acid, tetrasodium salt | 64-02-8 | Tetrasodium EDTA |
| Fatty acids, $C_{16}$-$C_{18}$, methyl esters[c] | 67762-38-3 | Fatty acid methyl esters[b] |
| Fatty acids, $C_{16}$-$C_{18}$ and $C_{18}$-unsatd, compounds with diethanolamine[a] | 68002-82-4 | Diethanolamine tallate[b] |
| Fatty acids, tall oil, compounds with diethanolamine | 61790-69-0 | Diethanolamine tallate |
| Hydrocarbons, terpene processing by-products[c] | 68956-56-9 | |
| *d*-Limonene[a] | 5989-27-5 | Cyclohexene, 1-methyl-4-(1-methylethenyl)-[b]; Terpenes[b] |
| Linalool[a] | 78-70-6 | 1,6-Octadien-3-ol, 3,7-dimethyl-[b] |
| Mineral spirits (light hydrotreated) | 64742-47-8 | Petroleum distillate[b] |
| N-Methylpyrrolidone | 872-50-4 | NMP |
| Naphtha (petroleum), hydrotreated heavy[c] | 64742-48-9 | Aliphatic petroleum distillate $C_9$-$C_{11}$[b] |
| Nerol[a] | 106-25-2 | 2,6-Octadien-1-ol, 3,7-dimethyl-[b] |
| Oxirane, methyl, polymer with oxirane, monodecyl ether[c] | 37251-67-5 | Linear alkyl ethoxylate[b] |
| 2-Pinanol[a] | 473-54-1 | Bicyclo[3.1.1]heptan-2-ol, 2,6,6-trimethyl-[b] |
| Plinols[b] | 72402-00-7 | Cyclopentanol, 1,2-dimethyl-3-(1-methylethenyl)-[c] |
| Polyethoxylated isodecyloxypropylamine[b] | 68478-95-5 | Poly(oxy-1,2-ethanediyl), α,α'-(iminodi-2,1-ethanediyl)bis[ω-hydroxy]-, N-[3-(branched decyloxy)propyl] derivatives[c] |
| Poly(oxy-1,2-ethanediyl), α-hexyl-ω-hydroxy-[c] | 31726-34-8 | Ethoxylated hexyl alcohol |
| Propanoic acid, 3-ethoxy-, ethyl ester[a] | 763-69-9 | Ethyl-3-ethoxy propionate |
| Propylene glycol | 57-55-6 | 1,2-Propanediol |
| Propylene glycol monobutyl ether | 5131-66-8 | 2-Propanol, 1-butoxy-[b] |
| Sodium bis(ethylhexyl) sulfosuccinate[b] | 577-11-7 | Butanedioic acid, sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt[c] |
| Sodium hydroxide | 1310-73-2 | Caustic soda |

| Chemical Name | CAS Number | Synonym |
|---|---|---|
| Sodium xylene sulfonate[b] | 1300-72-7 | Benzenesulfonic acid, dimethyl-, sodium salt[c] |
| Solvent naphtha (petroleum), heavy aromatic | 64742-94-5 | Aromatic 150[b] |
| Solvent naphtha (petroleum), light aliphatic | 64742-89-8 | VM&P naphtha[b] |
| Solvent naphtha (petroleum), light aromatic | 64742-95-6 | Aromatic petroleum distillate $C_8$-$C_{11}$[b] |
| Solvent naphtha (petroleum), medium aliphatic[c] | 64742-88-7 | Solvent 140[b] |
| Sorbitan, mono-9-octadecenoate[c] | 1338-43-8 | Sorbitan mono-oleate (crillet 4)[b] |
| Sorbitan, monododecanoate, poly(oxy-1,2-ethanediyl) derivatives[c] | 9005-64-5 | Laurate of polyoxyethylenic sorbitan[b] |
| Sorbitan, monolaurate | 5959-89-7 | D-Glucitol, 1,4-anhydro-, 6-dodecanoate[b] |
| Sorbitan, tri-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivatives[c] | 9005-70-3 | Ethoxylated sorbitan tri-oleate (crillet 45)[b] |
| Soybean oil, methyl ester[c] | 67784-80-9 | Soybean based methyl esters[b] |
| Soybean oil, polymerized, oxidized[c] | 68152-81-8 | Oxidized soybean oil[b] |
| Stoddard solvent[a] | 8052-41-3 | Mineral spirits |
| Tall oil, special | 68937-81-5 | Special tall oil[b]<br>methyl stearate, methyl oleate |
| α-Terpineol[a] | 98-55-5 | 3-Cyclohexene-1-methanol, α,α, 4-trimethyl-[b] |
| Terpinolene[a] | 586-62-9 | Cyclohexene, 1-methyl-4-(1-methylethylidene)-[b] |
| Tetrapotassium pyrophosphate[b] | 7320-34-5 | Diphosphoric acid, tetrapotassium salt[a] |
| Xylene | 1330-20-7 | Dimethyl benzene |

[a] Indicates that the name was chosen from the CHEMID Files.
[b] Indicates name supplied by industry.
[c] Indicates that the name was chosen from the TSCA Inventory.

# Alcohols, $C_{12}$-$C_{15}$, Ethoxylated

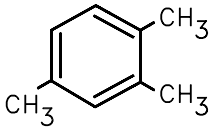
CAS# 68131-39-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: ethoxylated fatty alcohols; EMUL/Mix<br>Molecular weight: >200<br>Melting Point: <50°C (E)<br>Water Solubility: Dispersable (n=3 to 10) (E)<br>Vapor Pressure: <0.01 mm Hg (E)<br>$Log_{10}K_{ow}$: 3.40 (E)<br>$Log_{10}K_{oc}$: 3.97 (E)<br>$Log_{10}BCF$: 2.35 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 83-99 (E)<br>Chemistry of Use: Dispersant | Molecular formula varies<br>Structure:<br>  <br><br>Boiling Point: Decomposes (E)<br>Density: 0.95 g/$cm^3$ (E)<br>Flash Point: >100°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Benzene, 1,2,4-Trimethyl

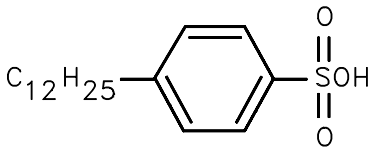
CAS# 95-63-6

| Chemical Properties and Information | |
|---|---|
| Synonyms: 1,2,4-trimethyl benzene; pseudocumene;<br>trimethyl benzene; asymmetrical trimethyl benzene<br>Molecular weight: 120.19<br>Melting Point: -43.78°C (M)<br>Water Solubility: 0.02 g/L (E)<br>Vapor Pressure: 10.34 torr (at 54.4°C) (M)<br>$Log_{10}K_{ow}$: 3.78 (M)<br>$Log_{10}K_{oc}$: 2.86 (M)<br>$Log_{10}BCF$: 2.53 (E)<br>Henry's Law: $6.58X10^{-3}$ atm-$m^3$/mole (M)<br>POTW Overall Removal Rate (%): 97-99 (E)<br>Chemistry of Use: Solvent component | $C_9H_{12}$<br>Structure:<br>  <br><br>Boiling Point: 169 -171°C (M)<br>Density: 0.876 g/$cm^3$ (M)<br>Flash Point: 54.4°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 2<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Benzenesulfonic Acid, Dodecyl-

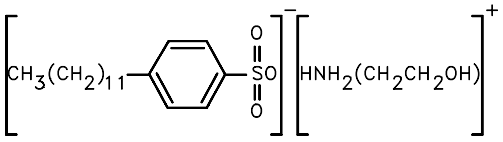
CAS# 27176-87-0

| Chemical Properties and Information | |
|---|---|
| Synonyms: DDBSA<br>Molecular weight: 326<br>Melting Point: Not available<br>Water Solubility: Miscible (E)<br>Vapor Pressure: $<10^{-4}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 4.78 (E)<br>$Log_{10}K_{oc}$: 4.23 (E)<br>$Log_{10}$BCF: 3.41 (E)<br>Henry's Law: $6.27X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 99.82-99.98 (E)<br>Chemistry of Use: Surfactant | $C_{18}H_{30}SO_3$<br>Structure:<br>  <br>Boiling Point: 204.5°C (M)<br>Density: 1.00 g/$cm^3$ (M)<br>Flash Point: 149° C (open cup) (M)<br>Safety Hazard Factors:<br>Corrosivity: Y |

Above data are either measured (M) or estimated (E)

# Benzenesulfonic Acid, Dodecyl-, Compounds with 2-Aminoethanol

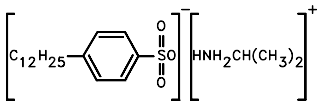
CAS# 26836-07-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: Dodecylbenzensulfonic acid, ethanolamine salt<br>Molecular weight: 387.59<br>Melting Point: Not available<br>Water Solubility: Dispersible (E)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}$ $K_{ow}$: Not available<br>$Log_{10}$ $K_{oc}$: Not available<br>$Log_{10}$ BCF: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 50-90 (E)<br>Chemistry of Use: Dispersant | $C_{20}H_{37}NO_4S$<br>Structure:<br>  <br>Boiling Point: Decomposes (E)<br>Density: 1 g/$cm^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Benzenesulfonic Acid, Dodecyl-, Compounds with 2-Propanamine

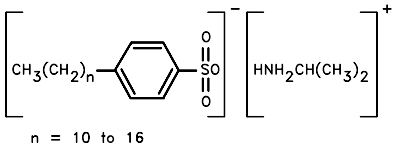
CAS# 26264-05-1

| Chemical Properties and Information | |
|---|---|
| Synonyms: isopropylamine salt of dodecylbenzenesulfonic acid<br>Molecular weight: 385.5<br>Melting Point: Not available<br>Water Solubility: Dispersible (E) (surfactant)<br>Vapor Pressure: $<10^{-5}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Dispersant | $C_{21}H_{39}NO_3S$<br>Structure:<br>  <br>Boiling Point: Decomposes (M)<br>Density: 1.03 g/cm$^3$ (M)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Benzenesulfonic Acid, $C_{10}$-$C_{16}$-Alkyl Derivatives, Compounds with 2-Propanamine

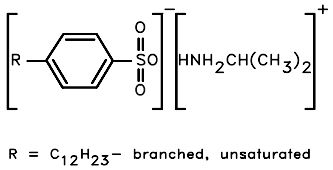
CAS# 68584-24-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: benzenesulfonic acid, $C_{10-16}$-alkyl derivatives,<br>compounds with isopropylamine<br>Molecular weight: 357-441<br>Melting Point: Not available<br>Water Solubility: Dispersible (surfactant) (E)<br>Vapor Pressure: $<10^{-5}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 4.78 (E)<br>$Log_{10}K_{oc}$: 4.23 (E)<br>$Log_{10}BCF$: 3.41 (E)<br>Henry's Law: $6.27X10^{-8}$ atm-m$^3$/mole (E)<br>POTW Overall Removal Rate (%): 83-99 (E)<br>Chemistry of Use: Dispersant | $C_{n+9}H_{2n+15}NSO_3$ (n=10-16)<br>Structure:<br>  <br>Boiling Point: Decomposes (E)<br>Density: 1.05 g/cm$^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Benzenesulfonic Acid, (Tetrapropenyl)-, Compound with 2-Propanamine

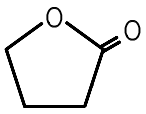
CAS# 157966-96-6

| Chemical Properties and Information | |
|---|---|
| Synonyms: Isopropylamine salt of (tetrapropenyl) benzenesulfonic acid<br>Molecular weight: 383.5<br>Melting Point: Not available<br>Water Solubility: Dispersible (E) (surfactant)<br>Vapor Pressure: $<10^{-5}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Dispersant | $C_{21}H_{37}NO_3S$<br>Structure:<br>  <br>R = $C_{12}H_{23}$– branched, unsaturated<br><br>Boiling Point: Decomposes (E)<br>Density: 1.0 g/cm$^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Butyrolactone

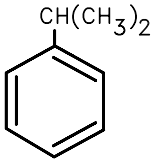
CAS# 96-48-0

| Chemical Properties and Information | |
|---|---|
| Synonyms: γ-butyrolactone; dihydro-2(3H)-furanone; 1,2-butanolide; 1,4-butanolide; γ-hydroxybutyric acid lactone; 3-hydroxybutyric acid lactone; 4-hydroxybutanoic acid lactone<br>Molecular weight: 86<br>Melting Point: -44°C (M)<br>Water Solubility: miscible (M)<br>Vapor Pressure: 3.2 mm Hg (25° C)(M)<br>$Log_{10}K_{ow}$: -0.640 (M)<br>$Log_{10}K_{oc}$: 0.85 (E)<br>$Log_{10}BCF$: -0.72 (E)<br>Henry's Law: 1.81 x $10^{-5}$ atm-m$^3$/mole (E)<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Solvent | $C_4H_6O_2$<br>Structure:<br>  <br><br>Boiling Point: 204°C (M)<br>Density: 1.125 g/mL (M)<br>Flash Point: Open cup: 98°C (M)<br>$K_{oc}$: 53 (E)<br>Physical state: Liquid<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 1<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Cumene

CAS# 98-82-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: benzene, (1-methylethyl)-; Isopropylbenzene<br>Molecular weight: 120.19<br>Melting Point: -96°C (M)<br>Water Solubility: Insoluble (M)<br>Vapor Pressure: 3.53 mm Hg (M)<br>$Log_{10}K_{ow}$: 3.66 (M)<br>$Log_{10}K_{oc}$: 2.91 (E)<br>$Log_{10}BCF$: 2.39 (E)<br>Henry's Law: $1.23X10^{-2}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 97-99 (E)<br>Chemistry of Use: Solvent component | $C_9H_{12}$<br>Structure:<br>  <br>Boiling Point: 152-153°C (M)<br>Density: 0.862 g/$cm^3$ (M)<br>Flash Point: 39°C (closed cup) (M)<br>Safety Hazard Factors:<br>Reactivity: 1<br>Flammability: 3<br>Ignitability: Y |

Above data are either measured (M) or estimated (E)

# Diethanolamine

CAS# 111-42-2

| Chemical Properties and Information | |
|---|---|
| Synonyms: ethanol, 2,2'-iminobis-; Iminodiethanol; 2,2'-dihydroxyethylamine;<br>Molecular weight: 105.14<br>Melting Point: 28°C (M)<br>Water Solubility: Very soluble<br>Vapor Pressure: Not available<br>$Log_{10}K_{ow}$: -1.43 (M)<br>$Log_{10}K_{oc}$: -0.85 (E)<br>$Log_{10}BCF$: -1.53 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 83.36-96.61 (E)<br>Chemistry of Use: Solvent | $C_4H_{11}NO_2$<br>Structure: $HOCH_2CH_2NHCH_2CH_2OH$<br>Boiling Point: 270°C (M)<br>Density: $1.0881_4^{\theta}$ g/mL (M)<br>Flash Point: 137°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 1<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Diethylene Glycol Monobutyl Ether

CAS# 112-34-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: 2-(2-butoxyethoxy) ethanol; butyl ethyl Cellosolve; diethylene glycol butyl ether; butyl Carbitol; Dowanol DB; Poly-Solv DB; butoxydiglycol, butyl digol, butyl diicinol<br>Molecular weight: 162.2<br>Melting Point: -68°C (M)<br>Water Solubility: Miscible (E)<br>Vapor Pressure: 0.02 mm Hg (E) (20° C)<br>$Log_{10}K_{ow}$: 0.56 (M)<br>$Log_{10}K_{oc}$: -0.55 (E)<br>$Log_{10}BCF$: 0.46 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Solvent | $C_8H_{18}O_3$<br>Structure: $C_4H_9OCH_2CH_2OCH_2CH_2OH$<br>Boiling Point: 231° C (M)<br>Density: 0.954 g/mL (M)<br>Flash Point: Open cup: 110°C (M)<br>Closed cup: 78°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 1<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Dimethyl Adipate

CAS# 627-93-0

| Chemical Properties and Information | |
|---|---|
| Synonyms: dimethyl hexanedioate; methyl adipate; dimethyl ester adipic acid<br>Molecular weight: 174.25<br>Melting Point: 8°C (M)<br>Water Solubility: 0.1 g/L (E)<br>Vapor Pressure: 0.06 mm Hg (25°C)(E)<br>$Log_{10}K_{ow}$: 1.39 (E)<br>$Log_{10}K_{oc}$: 1.04 (E)<br>$Log_{10}BCF$: 0.82 (E)<br>Henry's Law: 1.28 x $10^{-7}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 85-97 (E)<br>Chemistry of Use: Solvent | $C_8H_{14}O_4$<br>Structure: $(CH_3O)CO(CH_2)_4CO(OCH_3)$<br>Boiling Point: 193.7°C (at 760 mm Hg)(E)<br>Density: 1.063 g/mL (M)<br>Flash Point: 107°C (M)<br>Physical state: Colorless, odorless liquid<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Dimethyl Glutarate

CAS# 1119-40-0

| Chemical Properties and Information | |
|---|---|
| Synonyms: glutaric acid, dimethyl ester; pentanedioic acid, dimethyl ester<br>Molecular weight: 160.17<br>Melting Point: -42.5°C (M)<br>Water Solubility: 1 g/L (E)<br>Vapor Pressure: 0.1 mm Hg (E)<br>$Log_{10}K_{ow}$: 0.90 (E)<br>$Log_{10}K_{oc}$: 0.77 (E)<br>$Log_{10}BCF$: -0.14 (E)<br>Henry's Law: $9.09X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 97 (E)<br>Chemistry of Use: Solvent | $C_7H_{12}O_4$<br>Structure: $CH_3O_2C(CH_2)_3CO_2CH_3$<br>Boiling Point: 214°C (M)<br>Density: 1.088 g/$cm^3$ (M)<br>Flash Point: 100°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Dimethyl Succinate

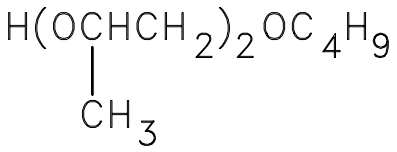
CAS# 106-65-0

| Chemical Properties and Information | |
|---|---|
| Synonyms: succinic acid, dimethyl ester; butanedioic acid, dimethyl ester; methyl succinate<br>Molecular weight: 146.14<br>Melting Point: 19°C (M)<br>Water Solubility: 8.3 g/L (M)<br>Vapor Pressure: 0.1 mm Hg (E)<br>$Log_{10}K_{ow}$: 0.19 (M)<br>$Log_{10}K_{oc}$: 0.48 (E)<br>$Log_{10}BCF$: Not available<br>Henry's Law: $5.8X10^{-6}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 97 (E)<br>Chemistry of Use: Solvent | $C_6H_{10}O_4$<br>Structure: $CH_3O_2C(CH_2)_2CO_2CH_3$<br>Boiling Point: 196.4°C (M)<br>Density: 1.12 g/$cm^3$ (M)<br>Flash Point: 100°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Dipropylene Glycol Monobutyl Ether

CAS# 29911-28-2

| Chemical Properties and Information | |
|---|---|
| Synonyms: 2-propanol, 1-(2-butoxy-1-methylethoxy)-; DGMBE<br>Molecular weight: 190.3<br>Melting Point: -73°C (M)<br>Water Solubility: Miscible (E)<br>Vapor Pressure: 0.044 mm Hg (M)<br>$Log_{10}K_{ow}$: 1.13 (E)<br>$Log_{10}K_{oc}$: -0.15 (E)<br>$Log_{10}BCF$: 0.63 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{22}O_3$<br>Structure:<br>  <br>Boiling Point: 229°C (M)<br>Density: 0.913 g/$cm^3$ (M)<br>Flash Point: 118° C (open cup) (M)<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Dipropylene Glycol Methyl Ether

CAS# 34590-94-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: glycol ether DPM; Dowanol DPM<br>Molecular weight: 148.2<br>Melting Point: -80°C (M)<br>Water Solubility: Miscible (E)<br>Vapor Pressure: 0.4 mm Hg (M) (25°C)<br>$Log_{10}K_{ow}$: -0.35 (E)<br>$Log_{10}K_{oc}$: 1.00 (E)<br>$Log_{10}BCF$: -0.49 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Solvent | $C_7H_{16}O_3$<br>Structure: $CH_3CHOHCH_2OCH_2CH(OCH_3)CH_3$<br>Boiling Point: 188.3°C (M)<br>Density: 0.951 g/mL (M)<br>Flash Point: 75°C (M)<br>Physical state: Liquid<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 2<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Distillates (Petroleum), Hydrotreated Middle

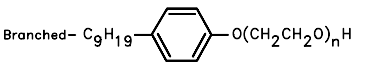
CAS# 64742-46-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: hydrotreated middle distillate<br>Molecular weight: Varies<br>Melting Point: -70°C (E)<br>Water Solubility: 0.003 g/L (E)<br>Vapor Pressure: 2 mm Hg (E)<br>$Log_{10}K_{ow}$: 5.25 (E)<br>$Log_{10}K_{oc}$: 3.24 (E)<br>$Log_{10}BCF$: 3.76 (E)<br>Henry's Law: 5.3 atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): ≈ 100 (E)<br>Chemistry of Use: Solvent | $C_nH_{2n+2}$ and $C_nH_{2n}$ (cycloparaffin)<br>Structure: No definite structure. Mixture of normal-, branched-, and cyclo-paraffins.<br>Boiling Point: 180-210°C (E)<br>Density: 0.78 g/$cm^3$ (E)<br>Flash Point: 50°C (E)<br>Safety Hazard Factors:<br>Ignitability: Y |

Above data are either measured (M) or estimated (E)

# Ethoxylated Nonylphenol

CAS# 9016-45-9, 26027-38-3, 68412-54-4

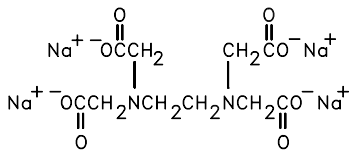
| Chemical Properties and Information | |
|---|---|
| Synonyms: poly(oxy-1,2-ethanediyl), α-(nonylphenyl)-Ω-hydroxy-; Antarox; polyethylene glycol mono (nonylphenyl) ether<br>Molecular weight: 630 (for n=9.5) (typical range 500 - 800)<br>Melting Point: -20 to +10°C (E)<br>Water Solubility: Soluble (M)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 3.93 (E) (np = 7)<br>$Log_{10}K_{oc}$: -0.19 (E) (np = 7)<br>$Log_{10}BCF$: Not available<br>Henry's Law: $1.81X10^{-22}$ atm-$m^3$/mole (E) (np = 7)<br>POTW Overall Removal Rate (%): 95 (M)[a]<br>Chemistry of Use: Nonionic surfactant | $C_{34}H_{62}O_{10}$ (for n=9.5)<br>Structure:<br>  <br><br>n = 9.5 (for screen printing formulation product)<br>Boiling Point: >300°C (E) (decomposes)<br>Density: 0.8 g/$cm^3$ (E)<br>Flash Point: 200 - 260°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

[a] *Based on testing data (Weeks, J.A. et al. 1996. Proceedings of the CESIO 4th World Surfactants Congress, Barcelona, Spain. Brussels, Belgium: European Committee on Surfactants and Detergents, pp. 276-91.) the original estimate of POTW removal has been changed from 100% to 95% in the final report. This revision results in increased estimates of the releases from POTWs to surface waters as described in section 3.3. When the releases to surface water are compared with the concern concentration set at the default value of 0.001 mg/L, the formulations containing ethoxylated nonylphenols (formulations 4, 5, 7, 8, 9, 17, 24, and 40) present concerns to aquatic species that were not reported in the draft CTSA.*

# Ethylenediaminetetraacetic acid, tetrasodium salt

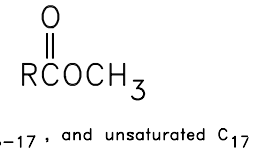
CAS# 64-02-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: Glycine, N,N'-1,2-ethanediylbis[N-(carboxymethyl)-, tetrasodium salt; Tetrasodium EDTA<br>Molecular weight: 380.20<br>Melting Point: >300°C (M)<br>Water Solubility: 1030 g/L (M)<br>Vapor Pressure: $<10^{-7}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 83.3-96.6 (E)<br>Chemistry of Use: Chelating agent | $C_{10}H_{12}NaN_2O_8$<br>Structure:<br>  <br>Boiling Point: Decomposes (E)<br>Density: 0.83 g/cm$^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Fatty Acids, $C_{16}$-$C_{18}$, Methyl Esters

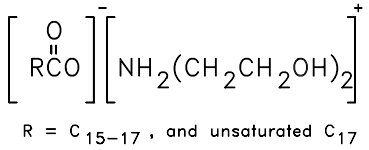
CAS# 67762-38-3

| Chemical Properties and Information | |
|---|---|
| Synonyms: fatty acid methyl esters<br>Molecular weight: 270-298<br>Melting Point: 27-36°C (M)<br>Water Solubility: <0.1 g/L (E)<br>Vapor Pressure: $<10^{-3}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 7.74 (E)<br>$Log_{10}K_{oc}$: 4.53 (E)<br>$Log_{10}BCF$: 5.65 (E)<br>Henry's Law: $2.00X10^{-2}$ atm-m$^3$/mole (E)<br>POTW Overall Removal Rate (%): 94-100 (E)<br>Chemistry of Use: Solvent | $C_{n+2}H_{2n+4}O_2$ (n=15 to 17) and<br>$C_{n+2}H_{2n+2}O_2$ (n=17)<br>Structure:<br>  <br>R = $C_{15-17}$, and unsaturated $C_{17}$<br>Boiling Point: 325°C (E)<br>Density: 0.88 g/cm$^3$ (E)<br>Flash Point: 200°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Fatty Acids, $C_{16}$-$C_{18}$ and $C_{18}$-unsatd., Compounds with Diethanolamine

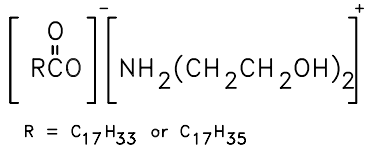
CAS# 68002-82-4

| Chemical Properties and Information | |
|---|---|
| Synonyms: diethanolamine tallate<br>Molecular weight: 361-390<br>Melting Point: Not available<br>Water Solubility: Dispersible (E)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 7.45 (E)<br>$Log_{10}K_{oc}$: 3.80 (E)<br>$Log_{10}$BCF: 5.43 (E)<br>Henry's Law: $5.23X10^{-5}$ atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 83-100 (E)<br>Chemistry of Use: Dispersant | $C_{n+5}H_{2n+13}NO_4$(n=15 to 17) and $C_{22}H_{45}NO_4$<br>Structure:<br>  <br><br>Boiling Point: Decomposes (E)<br>Density: >1 g/$cm^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Fatty acids, tall oil, Compounds with Diethanolamine

CAS# 61790-66-7

| Chemical Properties and Information | |
|---|---|
| Synonyms:<br>Molecular weight: 387 - 389<br>Melting Point: Not available<br>Water Solubility: Dispersible (E)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}$BCF: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 83-100 (E)<br>Chemistry of Use: Dispersant | $C_{22}H_{45}NO_4$ and •$C_{22}H_{47}NO_4$<br>Structure:<br>  <br><br>Boiling Point: Decomposes (E)<br>Density: >1 g/$cm^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Hydrocarbons, Terpene Processing By-Products

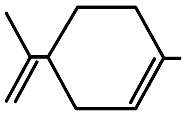
CAS# 68956-56-9

| Chemical Properties and Information | |
|---|---|
| Synonyms:<br>Molecular weight: ≥136<br>Melting Point: -40 to -60°C (E)<br>Water Solubility: 0.02 g/L (E)<br>Vapor Pressure: 1 mm Hg (E)<br>$Log_{10}K_{ow}$: 4.83 (E)<br>$Log_{10}K_{oc}$: 3.12 (E)<br>$Log_{10}BCF$: 3.44 (E)<br>Henry's Law: $3.80X10^{-1}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 98-100 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{16}$ and larger<br>Structure: Mixture of $C_{10}$ and larger terpenes.<br>Boiling Point: 165 - 180°C (E)<br>Density: 0.84 - 0.87 g/$cm^3$ (E)<br>Flash Point: 30 - 50°C (E)<br>Safety Hazard Factors:<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

# *d*-Limonene

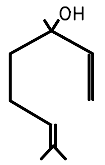
CAS# 5989-27-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: 1-methyl-4-(1-methylethenyl) cyclohexene; (+)-carvene; citrene; 1,8-*p*-menthadiene; 4-isopropenyl-1-methylcyclohexene cinene; cajeputene; kautschin<br>Molecular weight: 136<br>Melting Point: -74°C (M)<br>Water Solubility: 0.014 g/L (M)<br>Vapor Pressure: 5 mm Hg (E) (25°C)<br>$Log_{10}K_{ow}$: 4.83 (E)<br>$Log_{10}K_{oc}$: 3.12 (E)<br>$Log_{10}BCF$: 3.44 (E)<br>Henry's Law: $3.80X10^{-1}$ atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): >99 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{16}$<br>Structure:<br>  <br>Boiling Point: 176°C (M)<br>Density: 0.84 g/mL (M)<br>Flash Point: 48°C (M)<br>$K_{oc}$: 1,000 - 4,800 (E)<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Linalool

CAS# 78-70-6

| Chemical Properties and Information | |
|---|---|
| Synonyms: 1,6-octadien-3-ol, 3,7-dimethyl- | $C_{10}H_{18}O$ |
| Molecular weight: 154.24 | Structure:  |
| Melting Point: Not available | |
| Water Solubility: Practically insoluble (M) | |
| Vapor Pressure: 0.29 mm Hg (M) | |
| $Log_{10}K_{ow}$: 3.38 (E) | |
| $Log_{10}K_{oc}$: 1.75 (E) | |
| $Log_{10}BCF$: 2.34 (E) | |
| Henry's Law: $4.23X10^{-5}$ atm-$m^3$/mol (E) | |
| POTW Overall Removal Rate (%): 93-99 (E) | Boiling Point: 198-200°C (M) |
| Chemistry of Use: Solvent | Density: 0.8622 g/$cm^3$ (M) |
| | Flash Point: 74°C (E) |
| | Safety Hazard Factors: |
| | Reactivity: 0 |
| | Flammability: 2 |
| | Ignitability: N |

Above data are either measured (M) or estimated (E)

# Mineral Spirits (Light Hydrotreated)

CAS# 64742-47-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: many trade names by companies including Amsco, Apco, Epesol, Exxon, Phillips, Shell, etc., most of which include "mineral spirits" in the name | Molecular formula: $C_nH_{2n+2}$ (paraffin) and $C_nH_{2n}$ (cycloparaffin) |
| Molecular weight: 86 for n-hexane; 112 for ethycyclohexane, for example | Structure: Typical structures include normal paraffins, $CH_3(CH_2)_nCH_3$, branched paraffins, and cycloparaffins |
| Melting Point: -60°C (E) | Boiling Point: 140-180°C (M) |
| Water Solubility: 0.001 g/L (E) | Density: 0.78 g/mL (M) |
| Vapor Pressure: 0.5-1 mm Hg (E) (25°C) | Flash Point: <43°C (M) |
| $Log_{10}K_{ow}$: 3.90 (M) | Physical State: Liquid |
| $Log_{10}K_{oc}$: 2.17 (E) | Safety Hazard Factors: |
| $Log_{10}BCF$: 2.73 (E) | Reactivity: 0 |
| Henry's Law: 1.71 atm-$m^3$/mole (E) | Flammability: 2 |
| POTW Overall Removal Rate (%): >99 (E) | Ignitability: Y |
| Chemistry of Use: Solvent | |

Above data are either measured (M) or estimated (E)

# Naphtha (Petroleum), Hydrotreated Heavy

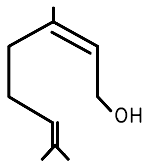
CAS# 64742-48-9

| Chemical Properties and Information | |
|---|---|
| Synonyms: aliphatic petroleum distillate $C_9$-$C_{11}$; naphthol spirits (aliphatic); hydrated lightstream cracked naphtha residuum (petroleum)<br>Molecular weight: 86 for n-hexane; 112 for ethylcyclohexane, for example<br>Melting Point: -80°C (E)<br>Water Solubility: 0.001 g/L (E)<br>Vapor Pressure: 1 mm Hg at 25°C (E)<br>$Log_{10}K_{ow}$: 4.27 (E)<br>$Log_{10}K_{oc}$: 2.70 (E)<br>$Log_{10}BCF$: 3.01 (E)<br>Henry's Law: 3.01 atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 99-100 (E)<br>Chemistry of Use: Solvent | $C_nH_{2n+2}$ (paraffin) and $C_nH_{2n}$ (cycloparaffin)<br>Structure: No definite structure. Mixture of normal-, branched-, and cyclo-paraffins<br>Boiling Point: 66-230°C (M)<br>Density: 0.8 g/ml (E)<br>Flash Point: 60°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 4<br>Ignitability: Y<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

# Nerol

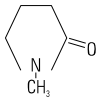
CAS# 106-25-2

| Chemical Properties and Information | |
|---|---|
| Synonyms: 2,6-octadiene-1-ol, 3,7-dimethyl-,<br>Molecular weight: 154.24<br>Melting Point: <-15.4°C (M)<br>Water Solubility: Insoluble (E)<br>Vapor Pressure: 0.06 mm Hg (M)<br>$Log_{10}K_{ow}$: 3.47 (E)<br>$Log_{10}K_{oc}$: 1.85 (E)<br>$Log_{10}BCF$: 2.41 (E)<br>Henry's Law: $5.89X10^{-5}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 94-99 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{18}O$<br>Structure:<br>  <br><br>Boiling Point: 224-225°C (M)<br>Density: 0.8756 g/$cm^3$ (M)<br>Flash Point: 77°C (M)<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# N-Methylpyrrolidone

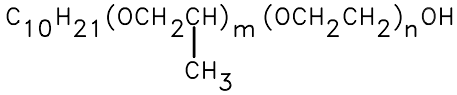
CAS# 872-50-4

| Chemical Properties and Information | |
|---|---|
| Synonyms: N-methylpyrrolidone [1-methyl-2-pyrrolidone; 1-methylazacyclopenta-2-one; N-methyl-γ-butyrolactam]; NMP<br>Molecular weight: 99.13<br>Melting Point: <-17 to -23°C (M)<br>Water Solubility: Miscible (M)<br>Vapor Pressure: 0.334 mm Hg (E) (25°C)<br>$Log_{10}K_{ow}$: -0.38 (M)<br>$Log_{10}K_{oc}$: 1.32 (E)<br>$Log_{10}BCF$: -0.31 (E)<br>Henry's Law: $3.16X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 97 (E)<br>Chemistry of Use: Solvent | $C_5H_9NO$<br>Structure:<br>  <br>Boiling Point:<br>202°C (M)<br>Density: 1.03 g/mL (M)<br>Flash Point: 96°C (M)<br>Safety Hazard Factors:<br>Reactivity: 1<br>Flammability: 3<br>Ignitability: Y |

Above data are either measured (M) or estimated (E)

# Oxirane, Methyl-, Polymer with Oxirane, Monodecyl Ether

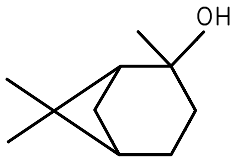
CAS# 37251-67-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: ethoxylated propoxylated decyl alcohol<br>Molecular weight: Varies<br>Melting Point: <-50°C (E)<br>Water Solubility: Dispersible (n=3 to 10) (E)<br>Miscible (n>10) (E)<br>Vapor Pressure: $<10^{-4}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 3.26 (E)<br>$Log_{10}K_{oc}$: 6.67 (E)<br>$Log_{10}BCF$: 2.25 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 1-95 (E)<br>Chemistry of Use: Dispersant | Molecular formula varies<br>Structure:<br>  <br>Boiling Point: Decomposes (E)<br>Density: <1 g/$cm^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# 2-Pinanol

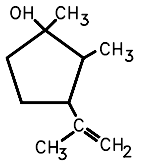
CAS# 473-54-1

| Chemical Properties and Information | |
|---|---|
| Synonyms: bicyclo[3.1.1]heptan-2-ol, 2,6,6-trimethyl-<br>Molecular weight: 154.24<br>Melting Point: 60 - 80°C (M)<br>Water Solubility: <0.1 g/L (E)<br>Vapor Pressure: $1.9x10^{-2}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 2.85 (E)<br>$Log_{10}K_{oc}$: 1.73 (E)<br>$Log_{10}BCF$: 1.94 (E)<br>Henry's Law: $1.90X10^{-6}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 88-98 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{18}O$<br>Structure:<br>  <br>Boiling Point: 220°C (M)<br>Density: 1.01 g/$cm^3$ (E)<br>Flash Point: 65°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Plinols

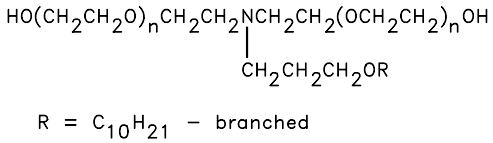
CAS# 72402-00-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: cyclopentanol, 1,2-dimethyl-3-(1-methylethenyl)-<br>Molecular weight: 154.24<br>Melting Point: 93°C (M)<br>Water Solubility: Very slightly soluble (E)<br>Vapor Pressure: <0.01 mm Hg (E)<br>$Log_{10}K_{ow}$: 3.34 (E)<br>$Log_{10}K_{oc}$: 1.74 (E)<br>$Log_{10}BCF$: 2.31 (E)<br>Henry's Law: $1.34X10^{-5}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 11-99 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{18}O$<br>Structure:<br>  <br>Boiling Point: 220°C (E)<br>Density: 0.92 g/$cm^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Polyethoxylated Isodecyloxypropylamine

CAS# 68478-95-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: poly(oxy-1,2-ethanediyl), α,α´-(iminodi-2,1 ethanediyl) bis[ω-hydroxy]-, N-[3-(branched decyloxy)propyl] derivatives<br>Molecular weight: >400<br>Melting Point: Not available<br>Water Solubility: Dispersible or soluble (depending on degree of ethoxylation) (E)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 0.92 (E)<br>$Log_{10}K_{oc}$: -1.43 (E)<br>$Log_{10}BCF$: 0.47 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 85-97 (E)<br>Chemistry of Use: Dispersant | Molecular formula varies<br>Structure:<br>  <br><br>Boiling Point: Decomposes (E)<br>Density: Not available<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Poly (Oxy-1,2-Ethanediyl), α-Hexyl-ω-Hydroxy-

CAS# 31726-34-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: ethoxylated hexyl alcohol<br>Molecular weight: >278<br>Melting Point: -10°C (E)<br>Water Solubility: Dispersible (n=3 to 10), Miscible (n>10) (E)<br>Vapor Pressure: <0.005 mm Hg (E)<br>$Log_{10}K_{ow}$: 0.73 (E)<br>$Log_{10}K_{oc}$: 1.58 (E)<br>$Log_{10}BCF$: 0.32 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Dispersant | $C_{2n+6}H_{4n+14}O_{n+1}$ (n>3)<br>Structure: $C_6H_{13}O(CH_2CH_2O)_nH$ (n>3)<br>Boiling Point: >270°C (E)<br>Density: >0.95 g/$cm^3$ (E)<br>Flash Point: >150°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Propanoic Acid, 3-Ethoxy-, Ethyl Ester

CAS# 763-69-9

| Chemical Properties and Information | |
|---|---|
| Synonyms: ethyl-3-ethoxy propionate; ethyl-β-ethoxy propionate<br>Molecular weight: 146.1<br>Melting Point: -100°C (M)<br>Water Solubility: Slightly soluble (1 g/L) (E)<br>Vapor Pressure: 0.9 mm Hg (at 20°C) (M)<br>$Log_{10}K_{ow}$: 1.08 (E)<br>$Log_{10}K_{oc}$: 0.61 (E)<br>$Log_{10}BCF$: 0.59 (E)<br>Henry's Law: $4.77X10^{-7}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 84-97 (E)<br>Chemistry of Use: Solvent | $C_7H_{14}O_3$<br>Structure: $CH_3CH_2OOCCH_2CH_2OCH_2CH_3$<br>Boiling Point: 170°C (M)<br>Density: 0.9496 g/$cm^3$ (M)<br>Flash Point: 82°C (open cup) (M)<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Propylene Glycol

CAS# 57-55-6

| Chemical Properties and Information | |
|---|---|
| Synonyms: 1,2-propanediol; methyl glycol; 1,2-dihydroxypropane; methylethylene glycol; trimethyl glycol<br>Molecular weight: 76.10<br>Melting Point: -60°C (M)<br>Water Solubility: Miscible<br>Vapor Pressure: 0.2 mm Hg at 20°C (M)<br>$Log_{10}K_{ow}$: -0.92 (M)<br>$Log_{10}K_{oc}$: 0.00 (E)<br>$Log_{10}BCF$: -0.82 (E)<br>Henry's Law: $1.74x10^{-7}$atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 97 (E)<br>Chemistry of Use: Solvent | $C_3H_8O_2$<br>Structure: $HOCH(CH_3)CH_2OH$<br>Boiling Point: 187.3°C (M)<br>Density: 1.038 g/mL (M)<br>Flash Point: 101°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 1<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Propylene Glycol Monobutyl Ether

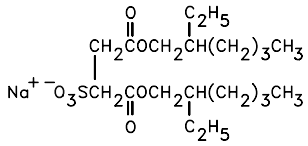
CAS# 5131-66-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: 2-propanol, 1-butoxy-<br>Molecular weight: 132<br>Melting Point: -100°C (M)<br>Water Solubility: 64 g/L (M)<br>Vapor Pressure: <0.98 mm Hg at 20°C (M)<br>$Log_{10}K_{ow}$: 0.98 (E)<br>$Log_{10}K_{oc}$: 0.11 (E)<br>$Log_{10}BCF$: 0.52 (E)<br>Henry's Law: $4.88X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Solvent | $C_7H_{16}O_2$<br>Structure: $C_4H_9OCH_2CH(CH_3)OH$<br>Boiling Point: 170°C (M)<br>Density: 0.89 g/$cm^3$ (E)<br>Flash Point: 59 (closed cup) (M)<br>Safety Hazard Factors:<br>Ignitability: Y |

Above data are either measured (M) or estimated (E)

# Sodium bis(Ethylhexyl) Sulfosuccinate

CAS# 577-11-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: butanedioic acid, sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt; sodium sulfosuccinate; Docusate sodium<br>Molecular weight: 444.37<br>Melting Point: Not available<br>Water Solubility: 15 g/L (at 25°C) (M)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 6.10 (E)<br>$Log_{10}K_{oc}$: 5.02 (E)<br>$Log_{10}BCF$: 4.40 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): nearly 100 (E)<br>Chemistry of Use: Surfactant | $C_{20}H_{37}NaO_7S$<br>Structure:<br>  <br>Boiling Point: Not available<br>Density: Not available<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Sodium Hydroxide

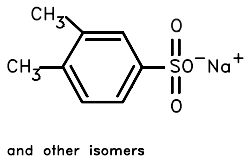
CAS# 1310-73-2

| Chemical Properties and Information | |
|---|---|
| Synonyms: caustic soda; lye; sodium hydrate; soda lye<br>Molecular weight: 39.9<br>Melting Point: 323°C (M)<br>Water Solubility: 1,180 g/L (E)<br>Vapor Pressure: Negligible (E); 1 mm Hg (M) (739°C)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): Not available<br>Chemistry of Use: Caustic | NaOH<br>Structure: NaOH<br>Boiling Point: 1390°C (M)<br>Density: 2.13 g/mL (M)<br>Flash Point: Not applicable<br>Physical State: Deliquescent orthorhombic white powder<br>Safety Hazard Factors:<br>Reactivity: 1<br>Flammability: 0<br>Ignitability: N<br>Corrosivity: Y |

Above data are either measured (M) or estimated (E)

# Sodium Xylene Sulfonate

CAS# 1300-72-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: benzenesulfonic acid, dimethyl-, sodium salt<br>Molecular weight: 208.09<br>Melting Point: Not available<br>Water Solubility: Very soluble (E)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Hydrotrope | $C_8H_9NaSO_3$<br>Structure:<br>  <br>and other isomers<br>Boiling Point: Not available<br>Density: Not available<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Solvent Naphtha (Petroleum), Heavy Aromatic

CAS# 64742-94-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: Aromatic 150; Comsolv 150<br>Molecular weight: 128 for naphthalene<br>Melting Point: -80°C (E)<br>Water Solubility: 0.03 g/L (M) for naphthalene<br>Vapor Pressure: 0.5 mm Hg (E) (25°C)<br>$Log_{10}K_{ow}$: 4.45 (M)<br>$Log_{10}K_{oc}$: 4.31 (E)<br>$Log_{10}BCF$: 3.15 (E)<br>Henry's Law: $2.56X10^{-5}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 96 (E)<br>Chemistry of Use: Solvent | $C_{10}H_8$ for naphthalene<br>Structure: Consist chiefly of aromatic hydrocarbons, including small fused-ring compounds such as naphthalene<br>Boiling Point: 150-290°C (E)<br>Density: 0.87 g/mL (E)<br>Flash Point: 38°C (E)<br>Physical State: Liquid<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 2<br>Ignitability: Y<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

# Solvent Naphtha (Petroleum), Light Aliphatic

CAS# 64742-89-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: VM&P #66; lacolene; rubber solvent; petroleum ether; naphtha; varnish makers' and painters' solvent; VM&P Naphtha<br>Molecular weight: 86 for n-hexane; 112 for ethycyclohexane, for example<br>Melting Point: <-80°C (M)<br>Water Solubility: 0.001 g/L (E)<br>Vapor Pressure: 20 mm Hg (E) (25°C)<br>$Log_{10}K_{ow}$: 3.44 (M)<br>$Log_{10}K_{oc}$: 2.22 (E)<br>$Log_{10}BCF$: 2.18 (E)<br>Henry's Law: $2.55X10^{-1}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): >94 (E)<br>Chemistry of Use: Solvent | Molecular Formula: $C_nH_{2n+2}$ (paraffin) and $C_nH_{2n}$ (cycloparaffin)<br>Structure: Typical structures include normal paraffins, $CH_3(CH_2)_nCH_3$, branched paraffins, and cycloparaffins<br>Boiling Point: 35-160°C (M)<br>Density: 0.7 g/mL (E)<br>Flash Point: 0°C (E)<br>Physical State: Liquid<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 3<br>Ignitability: Y<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

# Solvent Naphtha (Petroleum), Light Aromatic

CAS# 64742-95-6

| Chemical Properties and Information | |
|---|---|
| Synonyms: Comsolv 100<br>Molecular weight: 128 for naphthalene<br>Melting Point: -80°C (E)<br>Water Solubility: 0.03 g/L (M) for naphthalene<br>Vapor Pressure: 0.5 mm Hg (E) (25°C)<br>$Log_{10}K_{ow}$: 3.30 (M)<br>$Log_{10}K_{oc}$: 3.26 (E)<br>$Log_{10}BCF$: 2.28 (E)<br>Henry's Law: $3.70X10^{-4}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): >92 (E)<br>Chemistry of Use: Solvent | $C_{10}H_8$ for naphthalene<br>Structure: Consist chiefly of aromatic hydrocarbons, including small fused-ring compounds such as naphthalene<br>Boiling Point: 135-210°C (E)<br>Density: 0.87 g/mL (E)<br>Flash Point: 38°C (E)<br>Physical State: Liquid<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 2<br>Ignitability: Y<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

# Solvent Naphtha (Petroleum), Medium Aliphatic

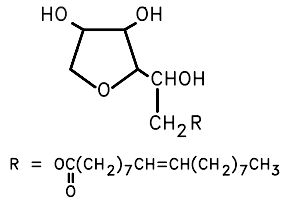
CAS# 64742-88-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: Solvent 140<br>Molecular weight: 86 for n-hexane; 112 for ethycyclohexane, for example<br>Melting Point: -60°C (M)<br>Water Solubility: 0.001 g/L (E)<br>Vapor Pressure: 1 mm Hg at 25°C (E)<br>$Log_{10}K_{ow}$: 5.64 (M)<br>$Log_{10}K_{oc}$: 3.77 (E)<br>$Log_{10}BCF$: 4.51 (E)<br>Henry's Law: 9.35 atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 99.98-100 (E)<br>Chemistry of Use: Solvent | $C_nH_{2n+2}$ (paraffin) and $C_nH_{2n}$ (cycloparaffin)<br>Structure: No definite structure. Mixture of normal-, branched-, and cyclo-paraffins.<br>Boiling Point: 176-210°C (M)<br>Density: 0.787 g/mL (M)<br>Flash Point: 60°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 2<br>Ignitability: Y<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

# Sorbitan, Mono-9-Octadecenoate,

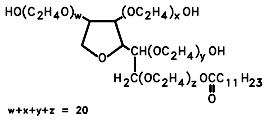
CAS# 1338-43-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: sorbitan mono-oleate, (crillet 4)<br>Molecular weight: 428.44<br>Melting Point: <20°C (E)<br>Water Solubility: Dispersible (M)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 5.89 (E)<br>$Log_{10}K_{oc}$: 2.75 (E)<br>$Log_{10}BCF$: 4.24 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 99.98-100 (E)<br>Chemistry of Use: Dispersant | $C_{24}H_{44}O_6$<br>Structure:<br>  <br>Boiling Point: Not available<br>Density: 1.0 g/$cm^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Sorbitan, Monododecanoate, Poly(Oxy-1,2-Ethanediyl) Derivatives

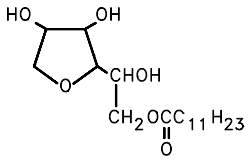
CAS# 9005-64-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: polysorbate - 20; polyoxy ethylene (20) sorbitan monolaurate; Tween 20; Laurate of polyoxyethylenic sorbitan<br>Molecular weight: 1,180<br>Melting Point: Not available<br>Water Solubility: Completely soluble (M); 1000 g/L (E)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 83-97 (E)<br>Chemistry of Use: Dispersant | $C_{54}H_{114}O_{26}$<br>Structure:<br>  <br>Boiling Point: Not available<br>Density: 1.1 g/$cm^3$ (M)<br>Flash Point: 148°C (closed cup) (M)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Sorbitan, Monolaurate

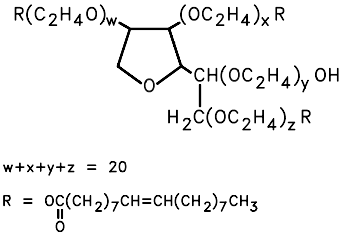
CAS# 5959-89-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: D-glucitol; 1,4-anhydro-, 6-dodecanoate<br>Molecular weight: 358.34<br>Melting Point: <20°C (E)<br>Water Solubility: Insoluble (M)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 3.15 (E)<br>$Log_{10}K_{oc}$: 1.16 (E)<br>$Log_{10}BCF$: 2.17 (E)<br>Henry's Law: $<1.00X10^{-8}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): 90-98 (E)<br>Chemistry of Use: Dispersant | $C_{18}H_{34}O_6$<br>Structure:<br>  <br>Boiling Point: 393°C (M)<br>Density: 1.0 g/$cm^3$ (E)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Sorbitan, Tri-9-Octadecenoate, Poly(Oxy-1,2-Ethanediyl) Derivatives

CAS# 9005-70-3

| Chemical Properties and Information | |
|---|---|
| Synonyms: sorbitan tri-oleate (crillet 45)<br>Molecular weight: 1,836 (n=20)<br>Melting Point: Not available<br>Water Solubility: Completely soluble (E)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 99.98-100 (E)<br>Chemistry of Use: Dispersant | $C_{100}H_{188}O_{28}$ (n=20)<br>Structure:<br>  <br>Boiling Point: Not available<br>Density: 1.1 g/$cm^3$ (E)<br>Flash Point: 160°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Soybean Oil, Methyl Ester

CAS# 67784-80-9

| Chemical Properties and Information | |
|---|---|
| Synonyms: soybean based methyl esters | $C_{19}H_{36}O_2$and $C_{19}H_{34}O_2$ |
| Molecular weight: 295 | Structure: $RCOOCH_3$ (R = $C_{17}H_{33}$ or $C_{17}H_{31}$) |
| Melting Point: -30°C (E) | Boiling Point: Decomposes (E) |
| Water Solubility: Insoluble (E) | Density: 0.883 g/cm$^3$ (E) |
| Vapor Pressure: 0.01 mm Hg (E) | Flash Point: 160-180°C (E) |
| $Log_{10}K_{ow}$: 7.80 (E) | Safety Hazard Factors: |
| $Log_{10}K_{oc}$: 4.79 (E) | Reactivity: 0 |
| $Log_{10}$BCF: 5.70 (E) | Flammability: 1 |
| Henry's Law: 2.03X10$^{-3}$ atm-m$^3$/mol (E) | Ignitability: N |
| POTW Overall Removal Rate (%): 94-100 (E) | |
| Chemistry of Use: Solvent | |

Above data are either measured (M) or estimated (E)

# Soybean Oil, Polymerized, Oxidized

CAS# 68152-81-8

| Chemical Properties and Information | |
|---|---|
| Synonyms: oxidized soybean oil | Molecular formula varies |
| Molecular weight: Varies | Structure: No definite structure |
| Melting Point: Not available | Boiling Point: Decomposes (E) |
| Water Solubility: Insoluble (E) | Density: Not available |
| Vapor Pressure: <10$^{-5}$ mm Hg (E) | Flash Point: Not available |
| $Log_{10}K_{ow}$: 15.33 (E) | Safety Hazard Factors: |
| $Log_{10}K_{oc}$: 13.73 (E) | Reactivity: 0 |
| $Log_{10}$BCF: 11.42 (E) | Flammability: 1 |
| Henry's Law: 1.00X10$^{-8}$ atm-m$^3$/mole (E) | Ignitability: N |
| POTW Overall Removal Rate (%): 99.98-100 (E) | |
| Chemistry of Use: | |

Above data are either measured (M) or estimated (E)

# Stoddard Solvent

CAS# 8052-41-3

| Chemical Properties and Information | |
|---|---|
| Synonyms: Rule 66 mineral spirits; quick-dry mineral spirits; 140 solvent; VM&P naphtha; dry cleaners' solvent.<br>Molecular weight: 86 for n-hexane; 112 for ethylcyclohexane, for example<br>Melting Point: -70°C (M)<br>Water Solubility: Insoluble (M)<br>Vapor Pressure: 1 mm Hg at 25°C (E)<br>$Log_{10}K_{ow}$: 5.25 (E)<br>$Log_{10}K_{oc}$: 3.24 (E)<br>$Log_{10}BCF$: 3.58 (E)<br>Henry's Law: 5.3 atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): ≈ 100 (E)<br>Chemistry of Use: Solvent | $C_nH_{2n+2}$ (paraffins), $C_nH_{2n}$ (cycloparaffins)<br>Structure: No definite structure. Mixture of normal-, branched-, and cyclo-paraffins<br>Boiling Point: 157-196°C (M)<br>Density: 0.787 (M)<br>Flash Point: 60°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 2<br>Ignitability: Y |

Above data are either measured (M) or estimated (E)

# Tall Oil, Special

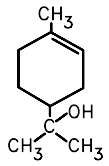
CAS# 68937-81-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: fatty acids, $C_{18}$ and $C_{18}$-unsatd., methyl esters, methyl stearate, methyl oleate<br>Molecular weight: 296-298<br>Melting Point: 36-39°C (E)<br>Water Solubility: Insoluble (M) (<0.1 g/L) (E)<br>Vapor Pressure: $<10^{-3}$ mm Hg (E)<br>$Log_{10}K_{ow}$: 7.74 (E)<br>$Log_{10}K_{oc}$: 4.53 (E)<br>$Log_{10}BCF$: 5.65 (E)<br>Henry's Law: $2.00X10^{-2}$ atm-$m^3$/mole (E)<br>POTW Overall Removal Rate (%): nearly 100 (E)<br>Chemistry of Use: Solvent | $C_{19}H_{36}O_2$ and $C_{19}H_{38}O_2$<br>Structure: $CH_3(CH_2)_{16}COOCH_3$ and $CH_3(CH_2)_7CH{=}CH(CH_2)_7COOCH_3$<br>Boiling Point: 325°C (E)<br>Density: 0.88 g/$cm^3$ (E)<br>Flash Point: 200°C (E)<br>Safety Hazard Factors:<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# α-Terpineol

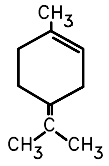
CAS# 98-55-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: 3-cyclohexene-1-methanol, α,α,4-trimethyl-;<br>p-menth-1-en-8-ol<br>Molecular weight: 154.24<br>Melting Point: 2°C (M)<br>Water Solubility: Slightly soluble (M)<br>Vapor Pressure: 0.12 mm Hg (M)<br>$Log_{10}K_{ow}$: 3.33 (E)<br>$Log_{10}K_{oc}$: 1.76 (E)<br>$Log_{10}BCF$: 2.30 (E)<br>Henry's Law: $3.15X10^{-6}$ atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 86-98 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{18}O$<br>Structure:<br>  <br>Boiling Point: 214-224°C (M)<br>Density: 0.9338 g/$cm^3$ (M)<br>Flash Point: 90°C (M)<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 2<br>Ignitability: N |

Above data are either measured (M) or estimated (E)

# Terpinolene

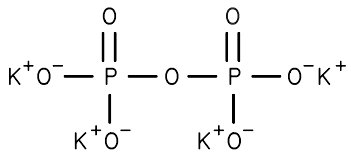
CAS# 586-62-9

| Chemical Properties and Information | |
|---|---|
| Synonyms: cyclohexene, 1-methyl-4-(1-methylethylidene)-; p-mentha-1,4(8)-diene<br>Molecular weight: 136.16<br>Melting Point: Not available<br>Water Solubility: Insoluble (M)<br>Vapor Pressure: 0.49 mm Hg (M)<br>$Log_{10}K_{ow}$: 4.88 (E)<br>$Log_{10}K_{oc}$: 3.12 (E)<br>$Log_{10}BCF$: 3.48 (E)<br>Henry's Law: $6.00X10^{-2}$ atm-$m^3$/mol (E)<br>POTW Overall Removal Rate (%): 90.06-99.95 (E)<br>Chemistry of Use: Solvent | $C_{10}H_{16}$<br>Structure:<br>  <br>Boiling Point: 183-185°C (M)<br>Density: 0.864 g/$cm^3$ (M)<br>Flash Point: 37.2°C (closed cup) (M)<br>Safety Hazard Factors:<br>Ignitability: Y<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

# Tetrapotassium Pyrophosphate

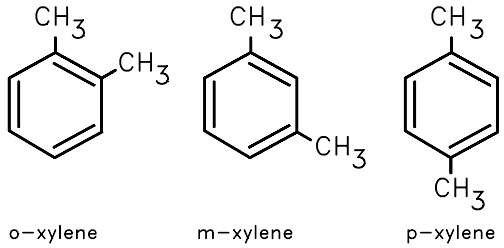
CAS# 7320-34-5

| Chemical Properties and Information | |
|---|---|
| Synonyms: diphosphoric acid, tetrapotassium salt; TKPP<br>Molecular weight: 330.34<br>Melting Point: 1090°C (M)<br>Water Solubility: 1,870 g/L (M)<br>Vapor Pressure: $<10^{-6}$ mm Hg (E)<br>$Log_{10}K_{ow}$: Not available<br>$Log_{10}K_{oc}$: Not available<br>$Log_{10}BCF$: Not available<br>Henry's Law: Not available<br>POTW Overall Removal Rate (%): 0-25 (E)<br>Chemistry of Use: Sequestering agent | $K_4O_7P_2$<br>Structure:<br>  <br>Boiling Point: Decomposes (E)<br>Density: 2.33 g/cm$^3$ (M)<br>Flash Point: Not available<br>Safety Hazard Factors: Not available |

Above data are either measured (M) or estimated (E)

# Xylene

CAS# 1330-20-7

| Chemical Properties and Information | |
|---|---|
| Synonyms: dimethylbenzene; methyltoluene; xylol<br>Molecular weight: 106.2<br>Vapor Pressure: 10 mm Hg (E) (25°C)<br>Water Solubility: 0.1 g/L (E)<br>Melting Point: o: -25°C (M)<br>m: -48°C (M)<br>p: 13°C (M)<br>$Log_{10}K_{ow}$: 3.15 (M)<br>$Log_{10}K_{oc}$: -0.69 (E)<br>$Log_{10}BCF$: 2.16 (E)<br>Henry's Law: $1.81X10^{-8}$ atm-m$^3$/mole (E)<br>POTW Overall Removal Rate (%): 94 (E)<br>Chemistry of Use: Solvent | $C_8H_{10}$<br>Structure:<br>  <br>o−xylene m−xylene p−xylene<br>Boiling Point: 137-140°C (M)<br>Density: 0.864 g/mL (M)<br>Flash Point: o: 17°C (M)<br>m: 29°C (M)<br>p: 27°C (M)<br>Physical State: Colorless liquid<br>Safety Hazard Factors:<br>Reactivity: 0<br>Flammability: 3<br>Ignitability: Y<br>Corrosivity: N |

Above data are either measured (M) or estimated (E)

## 2.3 HUMAN HEALTH HAZARD INFORMATION

Table 2-4 summarizes human health effects information obtained to date on chemicals used in lithographic blanket washes. Initial literature searches were limited to secondary sources such as EPA's Integrated Risk Information System (IRIS), the National Library of Medicine's Hazardous Substances Data Bank (HSDB), TOXLINE, TOXLIT, GENETOX, and the Registry of Toxic Effects of Chemical Substances (RTECS). The results of these literature searches are in the Administrative Record. These databases are established by other organizations as well as EPA, and are available by computerized online searching. They contain numeric and textual information that was used in developing the human health hazard summaries. These sources are considered secondary and no attempt has been made to verify the information contained in these sources. References typically are made to the database itself except for information taken from abstracts in TOXLINE and TOXLIT; in these cases, the author is cited with a notation to the database included in the text. Additionally, toxicologic data developed under the Office of Pollution Prevention and Toxics' Chemical Testing Program are incorporated in the human health hazard summary. Unpublished data submitted under TSCA §§ 8(d) and 8(e) are being reviewed and will be incorporated as appropriate in the final version of this document.

The "TOX ENDPOINT" column in Table 2-4 lists adverse toxicological effects that have been reported in the literature for animal or human studies. This is simply a qualitative listing of reported effects and does not imply anything about the severity of the effects nor the doses at which the effects occur. Furthermore, an entry in this column does not necessarily imply that EPA has reviewed the reported studies or that EPA concurs with the authors' conclusions. Toxicological effects are abbreviated as follows:

**car** = carcinogenicity
**chron** = chronic effects not otherwise listed. Target organ toxicity such as liver and kidney effects may be manifested by changes in size, structure, or function of the organ. For example, organ weight changes, changes in cell size or shape, or changes in enzyme activity associated with a particular organ are commonly reported endpoints in chronic toxicity studies.
**dev** = developmental toxicity, i.e., adverse effects on the developing embryo, fetus, or newborn
**gene** = genetic toxicity, such as point mutations or chromosomal aberrations
**g.i.** = gastrointestinal effects
**hema** = hematological effects, i.e., adverse effects on blood cells. Blood effects may involve changes in the number of blood cells as well as effects on their structure or function.
**neuro** = adverse neurological effects; includes a wide range of effects from serious neuropathology to transient CNS depression commonly seen with high exposures to solvents
**repro** = reproductive toxicity, i.e., adverse effects on the ability of either males or females to reproduce
**resp** = respiratory effects
**$LD_{50}$** = the dose (usually from a single dosing or short-term exposure) lethal to 50% of a test population

The "RfD/RfC" is the EPA Reference Dose (RfD) or Reference Concentration (RfC). The RfD is an estimate of a daily exposure to the human population that is likely to be without an appreciable risk of deleterious noncancer effects during a lifetime. The RfD is usually expressed as an oral dose in mg/kg/day. The RfC is an analogous value for continuous inhalation exposure, usually expressed in $mg/m^3$. The RfD/RfC values listed in Table 2-4 are used in the Hazard Quotient calculations shown in Section 3.4.

The "NOAEL/LOAEL" is the no-observed-adverse-effect level or the lowest-observed-adverse-effect level, respectively. The NOAEL is an exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects in the exposed population. The LOAEL is the lowest exposure level at which adverse effects have been shown to occur. The NOAEL/LOAEL values listed in Table 2-4 are used in the Margin of Exposure calculations shown in Section 3.4.

**Table 2-4. Human Health Hazard Summary**

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| Alcohols, $C_{12}$-$C_{15}$, ethoxylated | 33 | 68131-39-5 | dermal | | | | |
| | | | inhalation | neuro, g.i. | | | toxic effects based on acute or subacute (no. of doses not specified) oral study; the surfactant activity of this chemical will result in lung and eye irritation |
| Benzene, 1, 2, 4-trimethyl- | 21 | 95-63-6 | dermal | | | L - 5.71 mg/kg/day (urinary tract and enzyme effects)[a] | Included in TSCA Section 4 testing of $C_9$-hydrocarbons; 8(e) data available |
| | | | inhalation | neuro, chron[b] | | L - 20 mg/m$^3$ (urinary tract and enzyme effects) | |
| Benzenesulfonic acid, dodecyl- | 21 | 27176-87-0 | dermal | | | | |
| | | | inhalation | | | | oral $LD_{50}$ - 650 mg/kg[c] |
| Benzenesulfonic acid, dodecyl-, compounds with 2-aminoethanol | 31 | 26836-07-7 | dermal | g.i. | | N - 5 mg/kg/day (dermal) | data from dodecylbenzenesulfonic acid, triethanolamine salt studies |
| | | | inhalation | | | | |
| Benzenesulfonic acid, dodecyl- compounds with 2-propanamine | 32 | 26264-05-1 | dermal | | | | SAT report[k]; the surfactant activity of this chemical will result in lung irritation |
| | | | inhalation | | | | |
| Benzenesulfonic acid, (tetrapropenyl)-, compounds with 2-propanamime | 32 | 157966-96-6 | dermal | neuro (amine salt) | | | SAT report; the surfactant activity of the chemical will result in lung irritation |
| | | | inhalation | | | | |
| Benzenesulfonic acid, $C_{10}$-$C_{16}$ -alkyl derivatives, compounds with 2-propanamine | 32 | 68584-24-7 | dermal | sensitizer | | | SAT report; the surfactant activity of the chemical will result in lung irritation |
| | | | inhalation | | | | |

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| Butyrolactone | 21 | 96-48-0 | dermal | | | L - 500 mg/kg/day[d] (fetotoxicity) | |
| | | | inhalation | dev, repro, resp | | L - 500 mg/kg/day[d] (fetotoxicity) | toxic effects based on oral studies |
| Cumene | 29 | 98-82-8 | dermal | chron, g.i. | 0.4 mg/kg/day (chron)[d] | | toxic effects based on acute or subacute study (no. of doses not specified) |
| | | | inhalation | dev, repro, neuro, chron, resp | 1.4 mg/m$^3$ (chron)[d] | | TSCA §4, SIDS data available |
| Diethanolamine | 17 | 111-42-2 | dermal | repro, neuro, chron, g.i., hema | | L - 32 mg/kg/day (chron, hema) | |
| | | | inhalation | repro, neuro, chron, hema | | L - 14 mg/kg/day (chron, hema, decreased body weight gain)[d] | toxic effects based on oral studies; TSCA §4 review, SIDS dossier available |
| Diethylene glycol monobutyl ether | 27 28 | 112-34-5 | dermal | hema | | N - 191 mg/kg/day | TSCA §4, SIDS reviews available |
| | | | inhalation | dev, repro, chron, hema | | N - 14 ppm | no effects observed |
| Dimethyl adipate | 4 | 627-93-0 | dermal | | | L - 5.71 mg/kg/day (resp)[a] | TSCA §4 review available |
| | | | inhalation | resp | | L - 20 mg/m$^3$ (resp) | toxic effects based on study using mixture of dibasic esters |
| Dimethyl glutarate | 4 | 1119-40-0 | dermal | | | L - 5.71 mg/kg/day (resp)[a] | TSCA §4 review available |
| | | | inhalation | resp | | L - 20 mg/m$^3$ (resp) | toxic effects based on study using mixture of dibasic esters |

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| Dimethyl succinate | 4 | 106-65-0 | dermal | | | L - 5.71 mg/kg/day (resp)[a] | TSCA §4 review available |
| | | | inhalation | resp | | L - 20 mg/m$^3$ (resp) | toxic effects based on study using mixture of dibasic esters |
| Dipropylene glycol monobutyl ether | 21 | 29911-28-2 | dermal | neuro | | | dermal $LD_{50}$ - 5860 µL/kg[c] |
| | | | inhalation | | | | oral $LD_{50}$ - 1620 µg/kg[c] |
| Dipropylene glycol methyl ether | 9<br>30 | 34590-94-8 | dermal | | | N - (5 mL/kg) 4750 mg/kg/day | TSCA §4 dermal testing planned |
| | | | inhalation | neuro, chron, resp | | L - (200 ppm) 1213 mg/m3 (increased kidney weight)[e] | |
| Distillates (petroleum), hydrotreated middle | 22 | 64742-46-7 | dermal | | | | equivocal skin tumor response in mice through dermal exposure, positive Ames assay in multiple strains, with and without activation. No increased frequency of micronuclei in mouse bone marrow cells |
| | | | inhalation | | | | |
| Ethoxylated nonylphenol | 13<br>25 | 9016-45-9<br>26027-38-3<br>68412-54-4 | dermal | chron, resp, g.i. | | N - 500 mg/kg/day (dev/repro) | possible endocrine disrupter |
| | | | inhalation | dev, chron | | N- 30 mg/kg/day[d] | |
| Ethylenediaminetetraacetic acid, tetrasodium salt | 32 | 64-02-8 | dermal | | | | SAT report - low to moderate concern; poor skin absorption |
| | | | inhalation | | | | |
| Fatty acids, methyl esters[l] | 32 | 68002-82-4<br>67762-38-3<br>61790-69-0 | dermal | | | | SAT report; the surfactant activity of this chemical will result in eye and lung irritation |
| | | | inhalation | | | | |
| Hydrocarbons, terpene processing by-products | 32 | 68956-56-9 | dermal | | | | SAT report - low concern |
| | | | inhalation | | | | |

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| *d*-Limonene | 16 | 5989-27-5 | dermal | | | N - 250 mg/kg/day (increased hepatocyte nuclei and cytomegaly in male mice)[d] | |
| | | | inhalation | dev, repro, neuro, chron, hema | | N - 250 mg/kg/day (increased hepatocyte nuclei and cytomegaly in male mice)[d] | |
| Linalool | 18 | 78-70-6 | dermal | | | L - 500 mg/kg/day (increased liver weight)[d] | |
| | | | inhalation | neuro, chron | | L - 500 mg/kg/day (increased liver weight)[d] | toxic effects based on oral study |
| Mineral Spirits (light hydrotreated) | 7<br>20 | 64742-47-8 | dermal | | | | dermal $LD_{50}$ >5000mg/kg (rabbits)[c] limited evidence for carcinogenicity (IARC); appearance of papillomas at 50 mg for 80 weeks, no control data |
| | | | inhalation | | | | oral $LD_{50}$ - 8532 mg/kg[c] |
| N-Methylpyrrolidone | 1<br>10 | 872-50-4 | dermal | dev, repro | | N - 237 mg/kg/day (dev, repro) | TSCA §4 review available |
| | | | inhalation | chron, resp, hema | | N - (10 ppm) 40.5 $mg/m^3$[e] (chron) | |
| Naphtha (petroleum), hydrotreated heavy | 32 | 64742-48-9 | dermal | | | | SAT report - low moderate concern |
| | | | inhalation | resp, neuro | | | SAT report - low moderate concern; lung irritation |

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| Nerol | 22 | 106-25-2 | dermal | | | | SAT report; dermal $LD_{50}$ > 5000 mg/kg[c] |
| | | | inhalation | dev | | | SAT report; oral $LD_{50}$ - 4500 mg/kg[c] |
| Oxirane, methyl, polymer with oxirane, monodecyl ether | 32 | 37251-67-5 | dermal | | | | SAT report |
| | | | inhalation | | | | |
| 2-Pinanol | 32 | 473-54-1 | dermal | | | | SAT report |
| | | | inhalation | | | | |
| Plinols | 32 | 72402-00-7 | dermal | | | | no information available |
| | | | inhalation | | | | no information available |
| Polyethoxylated isodecyloxypropylamine | 32 | 68478-95-5 | dermal | | | | SAT report |
| | | | inhalation | | | | |
| Poly(oxy-1,2-ethanediyl), α -hexyl-ω-hydroxy- | 32 | 31726-34-8 | dermal | | | | SAT report |
| | | | inhalation | | | | |
| Propanoic acid, 3-ethoxyethyl ester | 22 | 763-69-9 | dermal | | | | dermal $LD_{50}$ - 10000 mg/kg |
| | | | inhalation | | | | oral $LD_{50}$ - 5000 mg/kg[c] |
| Propylene glycol | 11<br>21<br>29 | 57-55-6 | dermal | | 20 mg/kg/day (hema)[d] | | no evidence of carcinogenic effects by dermal exposure; questionably positive Salmonella test (host-mediated) with Strains G46 and TA1530; positive for chromosome aberrations in hamster fibroblasts, negative in other mammalian cells |
| | | | inhalation | chron, hema | 20 mg/kg/day (hema) | | toxic effects based on oral studies; no evidence of carcinogenic effects by oral exposure |

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| Propylene glycol monobutyl ether | 6<br>15 | 5131-66-8 | dermal | | | N - 11.40 mg/kg/day | no systemic effects at highest dose |
| | | | inhalation | chron, g.i. | | N - 400 mg/kg/day[d,f] | toxic effects based on oral studies |
| Sodium bis(ethylhexyl) sulfosuccinate | 12 | 577-11-7 | dermal | | | N - 50 mg/kg/day[d] (repro/dev) | sensitizer |
| | | | inhalation | dev, neuro, g.i. | | N - 50 mg/kg/day[d] (repro/dev) | toxic effects based on oral studies |
| Sodium hydroxide | 32 | 1310-73-2 | dermal | corrosive | | | |
| | | | inhalation | resp | | | |
| Sodium xylene sulfonate | 32 | 1300-72-7 | dermal | | | | SAT report |
| | | | inhalation | | | | |
| Solvent naphtha (petroleum), heavy aromatic | 32 | 64742-94-5 | dermal | | | | SAT report - moderate concern |
| | | | inhalation | | | | SAT report - moderate concern |
| Solvent naphtha (petroleum), light aliphatic | 32 | 64742-89-8 | dermal | hema | | N - 370 mg/kg/day[a] (hema) | SAT report |
| | | | inhalation | | | 1300 mg/m$^3$ (hema) | |
| Solvent naphtha (petroleum), light aromatic | 26 | 64742-95-6 | dermal | | | L - 140 mg/kg/day (repro, dev)[a,g] | |
| | | | inhalation | dev, repro | | L - (100 ppm) 491 mg/m$^3$ (repro, dev)[e,g] | |
| Solvent naphtha (petroleum), medium aliphatic | 5 | 64742-88-7 | dermal | neuro, resp | | L - 481 mg/kg/day (increased leucocytes)[a,h] | |
| | | | inhalation | neuro, chron, resp, hema | | L - (294 ppm) 1683 mg/m$^{3e}$ (increased leucocytes)[h] | |

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| Sorbitan, mono-9-octadecanoate | 8 | 1338-43-8 | dermal | | | N - 125 mg/kg/day (liver, kidney effects)[d] | |
| | | | inhalation | chron, g.i., hema | | N - 125 mg/kg/day (liver, kidney effects)[d] | toxic effects based on oral studies |
| Sorbitan, monododecanoate, poly(oxy-1,2-ethanediyl) derivatives | 19 | 9005-64-5 | dermal | | | N - 500 mg/kg/day (maternal tox/repro)[d] | |
| | | | inhalation | chron, g.i., hema | | N - 500 mg/kg/day (maternal tox/repro) | toxic effects based upon oral studies |
| Sorbitan, monolaurate | 32 | 5959-89-7 | dermal | | | | SAT report |
| | | | inhalation | chron, g.i., hema | | | |
| Sorbitan, tri-9-octadecanoate, poly(oxy-1,2-ethanediyl) derivatives | 32 | 9005-70-3 | dermal | | | | SAT report |
| | | | inhalation | chron, g.i., hema | | | |
| Soybean oil, methyl ester | 32 | 67784-80-9 | dermal | | | | SAT report |
| | | | inhalation | | | | |
| Soybean oil, polymerized, oxidized | 32 | 68152-81-8 | dermal | | | | SAT report |
| | | | inhalation | | | | |
| Stoddard solvent | 2 | 8052-41-3 | dermal | chron, g.i., hema | | L - 137 mg/kg/day (hema)[a,i] | |
| | | | inhalation | dev, neuro, chron, resp, g.i. | | L - (84 ppm) 481 mg/m$^3$ (hema)[e,i] | |
| Tall oil, special | 32 | 68937-81-5 | dermal | | | | SAT report |
| | | | inhalation | | | | |

| Chemical Name | Ref No.* | CAS No. | Worker Exposure | Toxicity Endpoint | RfD/RfC | NOAEL (N) or LOAEL (L) | Comment |
|---|---|---|---|---|---|---|---|
| α-Terpineol | 21 | 98-55-5 | dermal | | | | SAT report - low moderate concern |
| | | | inhalation | | | | oral $LD_{50}$s - 5170 mg/kg (rats) and 1208 mg/kg (mice) (mice-RTECS Search, 1995) |
| Terpinolene | 21 | 586-62-9 | dermal | | | | SAT report; oral $LD_{50}$ - 4390 mg/kg (rats)[c] |
| | | | inhalation | | | | |
| Tetrapotassium pyrophosphate | 23 | 7320-34-5 | dermal | | | N - 1250 mg/kg/day (chron)[d,j] | |
| | | | inhalation | chron | | N - 1250 mg/kg/day (chron)[j] | toxic effects based on oral studies |
| Xylene | 3<br>14<br>29 | 1330-20-7 | dermal | | 2 mg/kg/day (neuro)[d] | L - 150 mg/kg/day (increased liver weight)[d] | TSCA §4 review available |
| | | | inhalation | dev, neuro, chron, resp | (2 mg/kg/day) 7 $mg/m^3$ (neuro)[d] | L - 50 $mg/m^3$ (dev) | RfD based on oral study |

[a] Dermal NOAEL/LOAEL or RfD based upon inhalation data
[b] Chron - refers to chronic effect not otherwise listed; commonly includes target organ toxicity such as liver and kidney effects
[c] Available LD50's given only for those chemicals for which no other toxicity information was found
[d] Inhalation or dermal LOAEL/NOAEL or RfD based upon oral data
[e] Original data given in ppm, converted to $mg/m^3$ using the following conversion:

$$mg/m^3 = \frac{ppm \times \text{molecular weight (grams)}}{24.45}$$

[f] NOAEL based upon subacute study
[g] Molecular weight of 120 based upon C9 fraction
[h] Molecular weight of 40 based upon average molecular weight of components
[i] Molecular weight of 140 based upon average molecular weight of components
[j] For rats: ppm in diet x 0.05 = mg/kg/day
[k] SAT reports are generated by the OPPT Structure-Activity Team to predict toxicity based on analog data and/or structure-activity considerations.
[l] Fatty acids refers to: Fatty acids, $C_{16}$-$C_{18}$, methyl esters; Fatty acids, $C_{16}$-$C_{18}$ and $C_{18}$-unsatd., compounds with diethanolamine; and, Fatty acids, tall oil, compounds with diethanolamine

* The following references (with the exception of Nos. 24, 26, 27, 28, 29, and 32) were developed from online database searches conducted between February and May 1995. The toxicity data from these references are reported in Table 2-3 and in most cases the primary references were not reviewed.


1. Becci PJ, Knickerbocker MJ, Reagan EI, et al. 1982. Teratogenicity study of N-methylpyrrolidone after dermal application to Sprague-Dawley rats. Fund Appl Toxicol 2:73-76.

2. Carpenter CP, Kinkead ER, Geary DL, et al. 1975. Petroleum hydrocarbon toxicity studies. III. Animal and human responses to vapors of Stoddard solvent. Toxicol Appl Pharmacol 32:282-297.

3. Condie LW, et al. 1988. Oral toxicity studies with xylene isomers and mixed xylenes. Drug Chem Toxicol 11:329-354.

4. E.I. DuPont de Nemours and Company. 1985. FYI-OTS-0885-0433 INIT. Inhalation reproduction study in rats exposed to dibasic esters (DBE) (final Report) with attachments and cover letter dated 032792. Performed by Haskell Laboratory for Toxicology and Industrial Medicine. Washington DC: Office of Pollution Prevention and Toxics, U.S. EPA. EPA Doc. No. 88-920001533.

5. Exxon. 1980. TSCA sec 8(e) submission 8EHQ-1079-0312 follow up. A 12 Week Inhalation Toxicity Study of MRD-78-26 (Isopar C) in the Rat. Bio/dynamics Inc. Project No. 78-7092B. Washington, DC: Office of Toxic Substances, U.S. Environmental Protection Agency.

6. Hazleton. 1989. Hazleton Laboratories. 86-890000466S. A 91-day subchronic percutaneous toxicity with attachments, cover sheets and letter dated 061289 (sanitized). Office of Pollution Prevention and Toxics, U.S. EPA, Washington, D.C., 7pp.

7. IARC. 1989. International Agency for Research on Cancer. Occupational Exposures in Petroleum Refining. In: IARC Monographs on the Evaluation of Carcinogenic Risk to Humans, Vol. 45. Lyon, France: IARC.

8. Ingram AJ, et al. 1978. Short-term toxicity study of sorbitan monooleate (Span 80) in rats. Food Cosmet Toxicol 16(6):535.

9. Landy TD, Yano BL. 1984. Dipropylene glycol monomethyl ether: a 13-week inhalation toxicity study in rats and rabbits. Fundam Appl Toxicol 4:612-617.

10. Lee KP, Chromey NC, Culik R, et al. 1987. Toxicity of N-methyl-2-pyrrolidone (NMP): Teratogenic, subchronic, and two-year inhalation studies. Fund Appl Toxicol 9:222-225.

11. Litton Bionetics, Inc. 1974. Mutagenic Evaluation of Compound FDA 71-56, Propylene Glycol. Report No. LBI-2446-294, FDABF-GRAS-294. Kensington, MD: Bionetics, Inc. NTIS PB245450/2.

12. MacKenzie K, Henwood S, Foster G, et al. 1990. Three-generation reproduction study with dioctyl sodium sulfosuccinate in rats. Fundam Appl Toxicol 15(1):53-62.

13. Meyer O, Haubro Anderson P, Hansen EV, Larsen JC. 1988. Teratogenicity and *in vitro* mutagenicity studies on nonoxynol-9 and -30. Pharmacol Toxicol 62:235-238.

14. Mirkova E, et al. 1983. Prenatal toxicity of xylene. J Hyg Epidem Microb Immun 27337-343.

15. Notox. 1987. Toxicology Research and Consultancy C.V. 86-890001253. Assessment of the oral toxicity, including hemolytic activity, of Dowanol-PnB in the rat: 14-day study. Office of Pollution Prevention and Toxics., U.S. EPA, Washington, DC., 82 pp.

16. NTP. 1990. National Toxicology Program. Toxicology and Carcinogenesis Studies of d-Limonene (CAS No. 5989-27-5) in F344/N Rats and B6C3F1 Mice (gavage Studies). Research Triangle Park, NC: NTP. NTP TR 347.

17. NTP. 1992. National Toxicology Program. NTP Technical Report on Toxicology Studies of Diethanolamine (CAS no. 111-42-2) Administered Topically and in Drinking Water to F344/N Rats and B6C3F$_1$ mice. Technical Report Series No. 20. U.S. Department of Health and Human Services.

18. Powers KA, Beasley VR. 1985. Toxicological aspects of linalool: a review. Vet Hum Toxicol 27:484-486.

19. Price CJ, George JD, Marr MC, et al. 1992. Final Report on the developmental toxicity of polyoxyethylene sorbitan monolaurate (CAS no. 9005-64-5) in Sprague-Dawley (CD:) rats on gestational days 6 through 15. NTIS Technical Report (NTIS/PB93-123800); 130pp.

20. RTECS. 1993. Registry of Toxic Effects of Chemical Substances. MEDLARS Online Information Retrieval System, National Library of Medicine.

21. RTECS. 1994. Registry of Toxic Effects of Chemical Substances. MEDLARS Online Information Retrieval System, National Library of Medicine.

22. RTECS. 1995. Registry of Toxic Effects of Chemical Substances. MEDLARS Online Information Retrieval System, National Library of Medicine.

23. Shimoji N, Matsushima Y, Imaida K, et al. 1988. Subchronic oral toxicity of potassium pyrophosphate prior to long term carcinogenic studies in F344 rats. Eisei Shikensho Hokoku 106:66-72.

24. SIDS Initial Assessment Profile.

25. Smyth HF, Jr., Calandra JC. 1969. Toxicologic studies of alkylphenol polyoxyethylene surfactants. Toxicol Appl Pharmacol 14:315-334.

26. U.S. EPA. 1991. U.S Environmental Protection Agency. RM1 Report on C9 Aromatic Hydrocarbon Fraction. Office of Pollution Prevention and Toxics. Washington, DC.

27. TSCA §4 Study: 90-day dermal toxicity study.

28. Gingell R, et al. 1996. Toxicity of diethylene glycol butyl ether. Occupational Hygiene 2:293-302.

29. U.S. EPA. 1994. U.S. Environmental Protection Agency. Health Effects Assessment Summary Tables. Annual Update. Cincinnati, OH: Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, U.S. EPA.

30. U.S. EPA. Date not given. Chronic Skin Absorption of Propylene Glycol Methyl Ether (33B) and Dipropylene Glycol Methyl Ether (50B) in Rabbits. Washington, DC: Office of Toxic Substances, U.S. EPA. Doc #86-890001219.

31. Zondlo MM. 1993. Final report on the safety assessment of sodium dodecylbenzenesulfonate/TEA-dodecylbenzenesulfonate/sodium decylbenzenesulfonate. J Am Col Toxicol 12:279-309.

32. No information found in sources searched.

33. Bio/Dynamics, Inc. 1992. Initial Submission: Ethoxylated alcohol C12-15: Acute oral toxicity study in rats with cover letter dated 081092. TSCATS/431537. EPA/OTS Doc # 88-920006788.

## 2.4 ENVIRONMENTAL HAZARD INFORMATION

The chemicals in lithography are divided into three groups: (1) discrete organic chemicals, (2) petroleum products, and (3) inorganic chemicals. While the assessment process is the same for all three groups, the methodology used to provide estimates of the aquatic toxicity of the chemicals varies.

### 2.4.1 Methodology

The EPA Environmental Effects Branch uses a standard assessment process (see Appendix A) for assessing the hazards of chemicals to the aquatic environment. The process has been described in several publications, both inside and outside the Agency. A summary of the hazard assessment process and references are in Appendix A. The methodology involves the development of a standard hazard profile for each chemical consisting of three acute toxicity values and three chronic values for aquatic species. The standard hazard profile consists of the following toxicity values:

- Fish acute value (usually a fish 96-hour $LC_{50}$ value)
- Aquatic invertebrate acute value (usually a daphnid 48-hour $LC_{50}$ value)
- Green algal toxicity value (usually an algal 96-hour $EC_{50}$ value)
- Fish chronic value (usually a fish 28-day early life stage no effect concentration (NEC))
- Aquatic invertebrate chronic value (usually a daphnid 21-day NEC)
- Algal chronic value (usually an algal 96 hour NEC value for biomass)

For the acute values, the $LC_{50}$ (mortality) ($EC_{50}$) (effects) refers to the concentration that results in 50 percent of the test organisms affected at the end of the specified exposure period. The chronic values represent the concentration of the chemical that results in no statistically significant effects on the test organism following a chronic exposure.

The toxicity values may be obtained from the results of standard toxicity tests reported to the Agency, published in the literature, or estimated using predictive techniques. For this study, discrete organic chemicals were assessed using predictive equations called Structure Activity Relationships (SARs) to estimate the inherent toxicity of these chemicals to aquatic organisms. The literature sources that were searched to confirm these estimates are located in the Administrative Record. No data were found to conflict with these estimates. The toxicity values are for the discreet chemical only; interactions between chemicals within a formulation are not considered.

Although measured values are preferred, in the absence of test data, SAR estimates, if available for the chemical class, can be used. The predictive equations, i.e., quantitative structure-activity relationships, are used in lieu of test data to estimate toxicity values for aquatic organisms within a specific chemical class. The equations are derived from correlation and linear regression analysis based on measured data, however, the confidence interval associated with the equation is not used to provide a range of toxicity values. Thus, the hazard profile may consist of only measured data, only predicted values, or a combination of both. Also, the amount of data in the hazard profile may range from a minimum of one acute or chronic value to the full compliment of three acute values and three chronic values.

Some petroleum products such as mineral spirits and solvent naphtha are mixtures and do not lend themselves readily to the standard hazard assessment process using SARs. The chemical constituents and the percentage of each in the mixture varies. The constituents in these products include linear and branched paraffins, and cyclic paraffins with the total number of carbons varying between 5 and 16. The toxicity of the petroleum products were determined by estimating the toxicity of each individual constituent. Absent adequate description and characterization, the assumption is made that each component is present as an equal percentage in the product and the geometric mean of the range of estimates provides the best estimate of the toxicity. These assumptions many not be representative of the mixture currently on the market, but can be used for screening level hazard assessments. The toxicity of the individual components of the petroleum products is based on tests using pure samples. The potential by-products or impurities of petroleum distillation that are typically found in these mixtures were not incorporated in this hazard assessment.

The concentration of concern was also derived for each chemical. This value is derived by dividing the lowest of the three chronic values by a factor of 10. If the discharge of a chemical to the aquatic environment results in a concentration equal to or greater than the concern concentration set, then the chemical would be hazardous to aquatic organisms.

Assessment factors were used to incorporate the concept of uncertainty into the concern concentrations. Assessment factors account for laboratory tests versus field data and measured versus estimated data, as well as species sensitivity. In general, if only one toxicity value is available, there is a large uncertainty about the applicability of this value to other organisms in the environment and a large assessment factor, i.e., 1000, is applied to cover the breadth of sensitivity known to exist among and between organisms in the environment. Conversely, the more information that is available results in more certainty about the toxicity values, and requires the use of a smaller assessment factor. For example, if toxicity values are derived from field tests, then an assessment factor of 1 is used. Assessment factors of 1, 10, 100 and 1000 are generally applied for chronic risk depending on the amount and type of toxicity data in the hazard profile.

### 2.4.2 Results

The results of the estimated aquatic toxicity determinations are summarized in Table 2-5. The chemicals are listed alphabetically. No valid published literature were found to conflict with the estimated values. The full literature searches conducted are available in the Administrative Record. For each chemical, the estimated toxicity values in mg/L (ppm) for acute and chronic effects of fish, daphnid and algae are given. The last column shows the concern concentration set for the chemical in the water. Based on the methodology described in the previous section, the hazard potential of the various products are discussed in the following paragraphs.

Mineral Spirits

Mineral spirits consist of linear and branched paraffins and cyclic paraffins. Based on the information provided, the assessment was based on the estimated toxicity for n-hexane and ethylcyclohexane. The linear form of n-hexane is approximately two times more toxic than cyclic hexane. The lowest chronic value for n-hexane is 0.004 mg/L for fish and the lowest chronic value for ethylcyclohexane is 0.09 mg/L for fish.

Naphtha Solvents

The monomers associated with the various naphtha mixtures include linear and branched paraffins, cyclic paraffins and aromatics such as naphthalene. The carbon chain lengths vary from product to product and span the range from 5 to 16.

**Table 2-5. Estimated Aquatic Toxicity Values of Blanket Wash Chemicals Based on SAR Analysis (mg/L)**

| Chemical | Acute Toxicity | Acute Toxicity | | Chronic Toxicity | | | Concern Concen-tration |
|---|---|---|---|---|---|---|---|
| | Fish | Invert | Algal | Fish | Invert | Algal | |
| Alcohols, $C_{12}$-$C_{15}$, ethoxylated | 1.0 | 1.0 | 1.0 | 0.1 | 0.1 | 0.1 | 0.01 |
| Benzene, 1,2,4-trimethyl | 0.97 | 1.2 | 0.84 | 0.17 | 0.15 | 0.28 | 0.02 |
| Benzenesulfonic acid, dodecyl | 2.6 | 2.6 | 0.007 | 0.4 | 0.4 | 0.005 | 0.001 |
| Benzenesulfonic acid, dodecyl-, compounds with 2-aminoethanol | 2.6 | 2.6 | 30.0 | 0.4 | 0.3 | 10.0 | 0.03 |
| Benzenesulfonic acid, dodecyl-,compounds with 2-propanamine | 2.6 | 2.6 | 0.007 | 0.4 | 0.4 | 0.005 | 0.001 |
| Benzenesulfonic acid, (tetrapropenyl)-, compounds with 2-propanamine | 2.6 | 2.6 | 0.007 | 0.4 | 0.4 | 0.005 | 0.001 |
| Benzenesulfonic acid, $C_{10}$-$C_{16}$-alkyl derivatives, compounds with 2-propanamine | 0.75 | 0.75 | 0.002 | 0.12 | 0.12 | 0.001 | 0.001 |
| Butyrolactone | 140 | >1000 | >1000 | 14 | >100 | >100 | 1.4 |
| Cumene | 2.1 | 2.6 | 1.8 | 0.37 | 0.28 | 0.48 | 0.03 |
| Diethanolamine | >1000 | 220 | 130 | >100 | 22 | 12.8 | 1.3 |
| Diethylene glycol monobutyl ether | >1000 | >1000 | 860 | 140 | 40 | 40 | 4.0 |
| Dimethyl adipate | 140 | >1000 | 11 | 14 | >100 | 8.4 | 0.84 |
| Dimethyl glutarate | 245 | >1000 | 18 | 24 | >100 | 13.6 | 1.4 |
| Dimethyl succinate | 165 | >1000 | 12.5 | 16 | >100 | 9.3 | 0.9 |
| Dipropylene glycol monobutyl ether | 400 | 410 | 250 | 50 | 17 | 19 | 1.7 |
| Dipropylene glycol methyl ether | >1000 | >1000 | >1000 | 184 | 149 | 877 | 14.9 |
| Distillates (petroleum), hydrotreated, middle | 1.8 | 2.2 | 1.5 | 0.31 | 0.23 | 0.38 | 0.02 |
| Ethoxylated nonylphenol | 2.0 | 2.0 | 2.0 | 0.2 | 0.2 | 0.2 | 0.001[1] |
| Ethylenediaminetetraacetic acid, tetrasodium salt | 430 | 100 | 3.0 | 10.0 | 23.0 | 0.88 | 0.09 |
| Fatty acids, $C_{16}$-$C_{18}$ methyl esters | *[2] | * | * | * | * | * | * |
| Fatty acids, $C_{16}$-$C_{18}$ and $C_{18}$-unsatd, compounds with diethanolamine | 140 | 120 | 70 | 20 | 20 | 40 | 2.0 |
| Fatty acids, tall oil, compounds with diethanolamine | 160 | 200 | 100 | 20 | 30 | 20 | 2.0 |
| Hydrocarbons, terpene processing by-products | 0.86 | 1.1 | 0.76 | 0.16 | 0.14 | 0.27 | 0.01 |
| d-Limonene | 0.81 | 1.0 | 0.72 | 0.15 | 0.14 | 0.27 | 0.01 |
| Linalool | 45 | 50 | 32 | 6.1 | 3.0 | 4.1 | 0.3 |
| Mineral spirits (light hydrotreated) | 1.8 | 2.2 | 1.5 | 0.31 | 0.23 | 0.38 | 0.02 |
| N-Methylpyrrolidone | 1000 | 1000 | 1000 | 100 | 370 | 260 | 30 |
| Naptha (petroleum), hydrotreated heavy | * | * | * | 0.006 | 0.013 | 0.03 | 0.001 |
| Nerol | 28 | 31 | 20 | 4.0 | 2.1 | 3.0 | 0.21 |
| Oxirane, methyl, polymer with oxirane, monodecyl ether | 16 | 16 | 20 | 1.6 | 1.6 | 5.0 | 0.16 |
| 2-Pinanol | 31 | 35 | 22 | 4.4 | 2.3 | 3.2 | 0.23 |
| Pinols | 170 | 180 | 112 | 21 | 8.5 | 10.0 | 0.85 |
| Polyethoxylated isodecyloxypropylamine | 13 | 13 | 13 | 1.3 | 1.3 | 1.3 | 0.13 |
| Poly(oxy-1,2-ethanediyl), α-hexyl-ω-hydroxy | 320 | 320 | 300 | 32 | 32 | 40 | 3.2 |

| Chemical | Acute Toxicity | Acute Toxicity | | Chronic Toxicity | | | Concern Concen-tration |
|---|---|---|---|---|---|---|---|
| | Fish | Invert | Algal | Fish | Invert | Algal | |
| Propanoic acid, 3-ethoxy-, ethyl ester | 60 | 650 | 4.7 | 6.0 | 70 | 3.5 | 0.35 |
| Propylene glycol | >1000 | >1000 | >1000 | >100 | >100 | >100 | >10 |
| Propylene glycol monobutyl ether | >1000 | >1000 | >1000 | >100 | >100 | >100 | >100 |
| Sodium bis(ethylhexyl) sulfosuccinate | 3 | 3 | 3 | 5 | 5 | 3 | 0.05 |
| Sodium hydroxide | >1000 | >1000 | >1000 | >100 | >100 | >100 | >10 |
| Sodium xylene sulfonate | >1000 | >1000 | >1000 | >100 | >100 | >100 | >10 |
| Solvent naphtha (petroleum), heavy aromatic | 0.6 | 0.77 | 0.55 | 0.12 | 0.12 | 0.23 | 0.012 |
| Solvent naphtha (petroleum), light aliphatic | 3.3 | 3.9 | 2.6 | 0.53 | 0.36 | 0.58 | 0.036 |
| Solvent naphtha (petroleum), light aromatic | 5.5 | 6.5 | 4.4 | 0.88 | 0.59 | 0.93 | 0.059 |
| Solvent naphtha (petroleum), medium aliphatic | * | * | * | 0.001 | 0.002 | 0.005 | 0.001 |
| Sorbitan, mono-9-octadecenoate | 20 | 20 | 20 | 3 | 3 | 5 | 0.3 |
| Sorbitan, monododecanoate, poly(oxy-1,2-ethanediyl) derivatives | 20 | 20 | 20 | 3 | 3 | 3 | 0.3 |
| Sorbitan, monolaurate | 11 | 20 | 0.93 | 2 | 3 | 0.69 | 0.07 |
| Sorbitan, tri-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivatives | 20 | 20 | 20 | 3 | 3 | 3 | 0.3 |
| Soybean oil, methyl ester | * | * | * | * | * | * | * |
| Soybean oil, polymerized, oxidized | * | * | * | * | * | * | * |
| Stoddard solvent | 1.8 | 2.2 | 1.5 | 0.31 | 0.23 | 0.38 | 0.02 |
| Tall oil, special | * | * | * | * | * | * | * |
| α-Terpineol | 33 | 37 | 24 | 4.7 | 2.4 | 3.3 | 0.24 |
| Terpinolene | 0.81 | 1.0 | 0.72 | 0.15 | 0.14 | 0.26 | 0.014 |
| Tetrapotassium pyrophosphate | >100 | >100 | <1.0 | >10 | >10 | 0.06 | 0.006 |
| Xylene | 3.5 | 4.1 | 2.8 | 0.57 | 0.40 | 0.64 | 0.04 |

[1] There is a concern that this chemical may degrade to nonylphenol. Evidence suggests that nonylphenol may be an endocrine disrupter. Until such time as conclusive evidence resolves this issue, the concern concentration is set at 0.001 mg/L.

[2] * = No effects expected in a saturated solution during prescribed exposure period.

For the purpose of an overall assessment, the listed chemicals can be ranked according to the estimated chronic value. This hazard ranking, developed by the EPA Environmental Effects Branch, is based on scoring the chemicals as High, Moderate or Low concern for chronic effects according to the following criteria:

≤ 0.1 mg/L . . . . . High
≥ 0.1 to ≤ 10 mg/L . . . . . Moderate
> 10 mg/L . . . . . Low

See Appendix A for the basis and citations supporting these criteria and hazard rankings.

The results of this ranking are summarized in Table 2-6. The chemicals are ranked from the highest hazard potential to the lowest, based on lowest of the three estimated chronic values for each chemical. The petroleum products are rated as high hazard to aquatic organisms and the concern is for chronic effects. This relative ranking of toxicity provides guidance to the selection and use of chemicals that are less hazardous to aquatic organisms. In addition to this ranking system used by OPPT, other aquatic hazard ranking systems exist that could be applied.

**Table 2-6. Environmental Hazard Ranking of Blanket Wash Chemicals [1]**

| Chemical | CAS Number | Lowest Chronic Value (mg/L) | Hazard Rank |
|---|---|---|---|
| Ethoxylated nonylphenol | various given | | H[2] |
| Benzenesulfonic acid, $C_{10}$-$C_{16}$-alkyl derivatives, compounds with 2-propanamine | 68584-24-7 | 0.001 | H |
| Solvent naphtha (petroleum), medium aliphatic | 64742-88-7 | 0.001 | H |
| Benzenesulfonic acid, dodecyl- | 27176-87-0 | 0.005 | H |
| Benzenesulfonic acid, dodecyl,(tetrapropenyl)-, compounds with 2-propanamine | 157966-96-6 | 0.005 | H |
| Benzenesulfonic acid, dodecyl-, compounds with 2-propanamine | 26264-05-1 | 0.005 | H |
| Naphtha (petroleum), hydrotreated heavy | 64742-48-9 | 0.006 | H |
| Alcohols, $C_{12}$-$C_{15}$, ethoxylated | 68131-39-5 | 0.1 | H |
| Solvent naphtha (petroleum), heavy aromatic | 64742-94-5 | 0.12 | M |
| Hydrocarbons, terpene processing by-products | 68956-56-0 | 0.14 | M |
| d-Limonene | 5989-27-55 | 0.140 | M |
| Terpinolene | 586-62-95 | 0.140 | M |
| Tetrapotassium pyrophosphate | 7320-34-57 | 0.140 | M |
| Benzene, 1,2,4-trimethyl | 95-63-69 | 0.150 | M |
| Stoddard solvent | 8052-41-38 | 0.230 | M |
| Mineral spirits, light hydrotreated | 64742-47-8 | 0.23 | M |
| Distillates (petroleum), hydrotreated. middle | 64742-46-7 | 0.23 | M |
| Cumene | 98-82-8 | 0.28 | M |

| Chemical | CAS Number | Lowest Chronic Value (mg/L) | Hazard Rank |
|---|---|---|---|
| Benzenesulfonic acid, dodecyl-, compounds with 2-aminoethanol | 26836-07-7 | 0.30 | M |
| Solvent naphtha (petroleum), light aliphatic | 64742-89-8 | 0.36 | M |
| Xylene | 1330-20-7 | 0.4 | M |
| Sodium bis(ethylhexyl) sulfosuccinate | 577-11-7 | 0.5 | M |
| Solvent naphtha (petroleum), light aromatic | 64742-95-6 | 0.59 | M |
| Sorbitan, monolaurate | 5959-89-7 | 0.69 | M |
| Ethylenediaminetetraacetic acid, tetrasodium salt | 64-02-8 | 0.88 | M |
| Polyethoxylated isodecyloxypropylamine | 68478-95-5 | 1.3 | M |
| Oxirane, methyl, polymer with oxirane, monodecyl ether | 37251-67-5 | 1.6 | M |
| Nerol | 106-25-2 | 2.1 | M |
| 2-Pinanol | 473-54-1 | 2.3 | M |
| α-Terpineol | 98-55-5 | 2,4 | M |
| Sorbitan, mono-9-octadecenoate | 1338-43-8 | 3.0 | M |
| Linalool | 78-70-6 | 3.0 | M |
| Sorbitan, tri-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivatives | 9005-70-3 | 3.0 | M |
| Sorbitan, monododecanoate, poly(oxy-1,2-ethanediyl) derivatives | 9005-64-5 | 3.0 | M |
| Propanoic acid, 3-ethoxy-, ethyl ester | 763-69-9 | 3.5 | M |
| Dimethyl adipate | 627-93-0 | 8.4 | M |
| Pinols | 72402-00-7 | 8.5 | M |
| Dimethyl succinate | 106-65-0 | 9.3 | M |
| Diethanolamine | 111-42-2 | 13 | L |
| Dimethyl glutarate | 1119-40-0 | 13 | L |
| Butyrolactone | 96-48-0 | 14 | L |
| Dipropylene glycol monobutyl ether | 29911-28-2 | 17 | L |
| Propylene glycol monobutyl ether | 5131-66-8 | 20 | L |
| Fatty acids, $C_{16}$-$C_{18}$, compounds with diethanolamine | 68002-82-4 | 20 | L |
| Fatty acids, tall oil, compounds with diethanolamine | 61790-69-0 | 20 | L |
| Poly(oxy-1,2-ethanediyl), α-hexyl- -hydroxy | 31726-34-8 | 32 | L |
| Diethylene glycol monobutyl ether | 112-34-5 | 40 | L |
| Propylene glycol | 57-55-6 | 100 | L |
| Sodium xylene sulfonate | 1300-72-7 | 100 | L |

| Chemical | CAS Number | Lowest Chronic Value (mg/L) | Hazard Rank |
|---|---|---|---|
| Sodium hydroxide | 1310-73-2 | 100 | L |
| N-Methylpyrrolidone | 872-50-4 | 100 | L |
| Dipropylene glycol methyl ether | 34590-94-8 | 149 | L |
| Tall oil, special | 68937-81-5 | *[3] | L |
| Fatty acids, $C_{16}$-$C_{18}$, methyl esters | 67762-38-3 | * | L |
| Soybean oil, methyl esters | 67784-80-9 | * | L |
| Soybean oil, polymerized, oxidized | 68152-81-8 | * | L |

[1] Ranking based on the lowest estimated chronic value; H = High, M = Moderate, L = Low.
[2] There is a concern that this chemical may degrade to nonylphenol. Evidence suggests that nonylphenol may be an endocrine disrupter. Until such time as conclusive evidence resolves this issue, a "high" aquatic hazard ranking is automatically assigned whenever a compound contains nonylphenol.
[3] * = No effects in a saturated solution during the prescribed test duration.

## 2.5 FEDERAL REGULATORY STATUS

This section describes the federal environmental regulations that may affect the use of blanket wash chemicals. Information on the OSHA PELs is provided for informational purposes only. Discharges of blanket wash chemicals may be restricted by air, water and solid waste regulations; in addition, facilities may be required to report releases of some blanket wash products subject to the federal Toxic Release Inventory (TRI) program. Table 2-7 identifies federal regulations that govern releases of specific blanket wash chemicals; in addition, emissions or disposal of some chemicals may be regulated under general provisions. **This discussion of environmental statutes potentially affecting blanket wash chemicals is intended for information purposes only. Therefore, it should not be relied on by companies in the printing industry to determine applicable regulatory requirements.**

**Table 2-7. Blanket Wash Use Cluster Chemicals Which Trigger Federal Environmental Regulations[a]**

| Chemical | CAS# | CWA 311 RQ (lbs) | CAA 112B Hazardous Air Pollutant | CERCLA RQ (lbs) | SARA 313 (TRI) | OSHA PEL (ppm)[b] | RCRA |
|---|---|---|---|---|---|---|---|
| Benzene, 1,2,4-trimethyl | 95-63-6 | | | | X | | |
| Cumene | 98-82-8 | | X | 5,000 | X | 50 | U055 |
| Diethanolamine | 111-42-2 | | X | | X | | |
| Ethylene glycol ethers[c] | see below | | X | | X | 100[d] | |
| Dodecylbenzene sulfonic acid | 27176-87-0 | 1,000 | | 1,000 | | | |
| N-Methylpyrrolidone | 872-50-4 | | | | X | | |
| Sodium bis(ethylhexyl) sulfosuccinate | 577-11-7 | | | | | 2[e] | |
| Sodium hydroxide | 1310-73-2 | 1,000 | | 1,000 | | 2[e] | |
| Stoddard solvent | 8052-41-3 | | | | | 100 | |
| Xylene | 1330-20-7 | 1,000 | X | 1,000 | X | 100 | U239 |

[a] See following pages for a description of each acronym and regulation.
[b] Permissible Exposure Limit (PEL) as an eight-hour Time Weighted Average concentration (ppm).
[c] The generic chemical category Glycol ethers is listed as a CAA 112B Hazardous Air Pollutant (HAP) and on SARA 313 TRI. The only glycol ether found in these blanket washes that is considered a HAP is diethylene glycol monobutyl ether (CAS No. 112-34-5). The propylene glycol ethers are not included in the glycol ether category under this law and are not considered HAPs.
[d] Dipropylene glycol methyl ether has a PEL of 100 ppm.
[e] OSHA ceiling value.

The applicability of many federal regulations is determined in part by the chemicals being used at a facility. This section covers chemicals that the printing industry has identified as being used in the lithographic blanket wash process. However, individual facilities have their own chemical use patterns, which means that a particular facility may use chemicals that are not listed on Table 2-7, or may use some but not all of them. As a result, each facility must identify the universe of rules that apply to it by examining the regulations themselves.

This section only discusses federal environmental statutes. However, implementation of many federal programs is delegated to states that have programs at least as stringent as the applicable federal program. Thus, even where federal regulations apply, state laws may impose additional requirements that are not addressed here. There may also be state or local requirements where no federal regulations exist. This section provides an overview of federal regulations affecting the lithography sector of the commercial printing industry and of the specific chemicals used in the blanket wash use cluster that may trigger particular regulatory requirements.

Clean Water Act

The Clean Water Act (CWA) is the basic Federal law governing water pollution control in the United States today.

Part 116 of the Federal Water Pollution Control Act (FWPCA) designates hazardous substances under Section 311(b)(2)(a) of the Clean Water Act, and Part 117 of the FWPCA establishes the *Reportable Quantity* (RQ) for each substance listed in Part 116. When an amount equal to or in excess of the RQ is discharged, the facility must provide notice to the Federal government of the discharge, following Department of Transportation requirements set forth in 33 Code of Federal Regulations (CFR) 153.203. This requirement does not apply to facilities that discharge the substance under a National Pollution Discharge Elimination System (NPDES) permit or a Part 404 Wetlands (dredge and fill) permit, or to a Publicly Owned Treatment Works (POTW), as long as any applicable effluent limitations or pretreatment standards have been met.

The NPDES permit program contains regulations governing the discharge of pollutants to waters of the United States. The NPDES program requires permits for the discharge of "pollutants" from any "point source" into "navigable waters". The Clean Water Act defines all of these terms broadly, and a source will be required to obtain an NPDES permit if it discharges almost anything directly to surface waters. A source that sends its wastewater to a publicly owned treatment works (POTW) will not be required to obtain an NPDES permit, but may be required to obtain an industrial user permit from the POTW to cover its discharge.

In addition to other permit application requirements, facilities in the industrial category of Printing and Publishing, and/or in Photographic Equipment and Supplies, will need to test for all 126 *priority pollutants* listed in 40 CFR 122 Appendix D. Each applicant also must indicate whether it knows or has reason to believe it discharges any of the other hazardous substances, or non-conventional pollutants located at 40 CFR 122 Appendix D. Quantitative testing is not required for the other hazardous pollutants; however, the applicant must describe why it expects the pollutant to be discharged and provide the results of any quantitative data about its discharge for that pollutant. Quantitative testing is required for the non-conventional pollutants if the applicant expects them to be present in its discharge.

For the purpose of reporting on effluent characteristics in permit applications, there exists a small business exemption (40 CFR 122.21 (g)(8)) for all applicants for NPDES permits with gross total annual sales averaging less than $100,000 per year (in second quarter 1980 dollars). This exempts the small business from submitting quantitative data on certain organic toxic pollutants (see 40 CFR 122.21 Table II, Appendix D). However, the small business must still provide

quantitative data for other toxic pollutants (metals and cyanides) and total phenols, as listed in 40 CFR 122.21 Table III, Appendix D. The same regulations apply to the small business concerning the other hazardous pollutants and non-conventional pollutants as for the larger facilities (see previous paragraph).

Clean Air Act

The Clean Air Act (CAA), with its 1990 amendments, sets the framework for air pollution control. Part 112 of the Clean Air Act establishes requirements that directly restrict the emission of 189 hazardous air pollutants. The EPA is authorized to establish Maximum Achievable Control Technology (MACT) standards for source categories that emit at least one of the pollutants on the list.

Comprehensive Environmental Response, Compensation and Liability Act

The Comprehensive Environmental Response, Compensation and Liability Act (also known as CERCLA, or more commonly as Superfund) is the Act that created the Superfund and set up a variety of mechanisms to address risks to public health, welfare, and the environment caused by hazardous substance releases.

Substances deemed hazardous by CERCLA are listed in 40 Code of Federal Regulations (CFR) 302.4. Based on criteria that relate to the possibility of harm associated with the release of each substance, CERCLA assigns a substance-specific reportable quantity (RQ); RQs are either 1, 10, 100, 1000, or 5000 pounds (except for radionuclides). Any person in charge of a facility (or a vessel) must immediately notify the National Response Center as soon as a person has knowledge of a release (within a 24-hour period) of an amount of a hazardous substance that is equal to or greater than its RQ.[b] There are some exceptions to this requirement, including exceptions for certain continuous releases and for Federally permitted releases.

Superfund Amendments and Reauthorization Act, Section 313

CERCLA was enacted in 1980 and, among other amendments, was amended in 1986 by Title I of the Superfund Amendments and Reauthorization Act (SARA). Under SARA Section 313, a facility that has more than 10 employees and that manufactures, processes or otherwise uses more than 10,000 or 25,000 pounds per year of any toxic chemical listed in 40 Code of Federal Regulations (CFR) 372.65 must file a toxic chemical release inventory (TRI) reporting form (EPA Form R) covering releases of these toxic chemicals (including those releases specifically allowed by EPA or State permits) with the EPA and a State agency. The threshold for reporting releases is 10,000 or 25,000 pounds, depending on how the chemical is used (40 CFR 372.25). Form R is filed annually, covers all toxic releases for the calendar year, and must be filed on or before the first of July of the following year. Table 2-7 lists chemicals used by facilities in lithographic blanket washes that are listed in the Toxic Release Inventory (TRI). Individual facilities may use other chemicals which are listed in the TRI, but are not in Table 2-7.

Superfund Amendments and Reauthorization Act, Section 110

SARA Section 110 addresses Superfund site priority contaminants. This list contains the 275 highest ranking substances of the approximately 700 prioritized substances. These chemical substances, found at Superfund sites, are prioritized based on their frequency of occurrence,

[b] *The national toll-free number for the National Response Center is (800)-424-8802; in Washington, D.C., call (202)-426-2675.*

toxicity rating, and potential human exposure. Once a substance has been listed, the Agency for Toxic Substances and Disease Registry is mandated to develop a toxicological profile that contains general health/hazard assessments with effect levels, potential exposures, uses, regulatory actions, and further research needs.

Occupational Safety and Health Act

The Occupational Safety and Health Administration (OSHA) was established in 1970 under the Occupational Safety and Health (OSH) Act to reduce the occurrence of occupational health hazards, and to develop health and safety standards and training programs.

As authorized by Sections 6(a) of the OSH Act, which enables OSHA to promulgate existing Federal standards and national consensus standards as OSHA standards, the Health Standards program of OSHA established permissible exposure limits (PELs) for general industry Air Contaminants (29 CFR 1910.1000). A PEL is a total weighted average (TWA) concentration that is not to be exceeded in an 8 hour workday of a 40 hour work week, assuming a 50 week work year and 40 years of work. The majority of PELs were adopted from the Walsh-Healey Public Contracts Act which adopted standards from the 1968 Threshold Limit Values (TLV) of the American Conference of Governmental Industrial Hygienists (ACGIH).

On June 7, 1988, in an effort to increase the protection of the American workers, OSHA proposed to revise the PELs by adding 164 substances to the list and lowering the PEL for 212 of the 600 substances currently listed. OSHA also wanted to establish skin designations, short term exposure limits (STELs) and ceiling limits for these substances. Before the proposed changes went into effect, the ruling in the case of AFL-CIO v. OSHA in the 11th Circuit Court of Appeals rendered the revised PELs, STELs and ceiling limits invalid, reasoning that the PELs were generic health standards, not individual standards. Therefore, the 212 currently listed substances are enforced at the 1971 PELs and the 164 newly proposed PELs are not enforceable by OSHA. However, the "general duty clause" in Section 5(a)(1) of the OSH Act may be considered when the "unofficial" PELs of the 164 added substances are exceeded. The ruling prompted OSHA to begin developing individual PELs, STELs and ceiling limits for the substances included in the Health Standards program.

Resource Conservation and Recovery Act

One purpose of the Resource Conservation and Recovery Act (RCRA) of 1976 (as amended in 1984) is to set up a cradle-to-grave system for tracking and regulating hazardous waste. The EPA has issued regulations, found in 40 CFR Parts 260-299, which implement the Federal statute. These regulations are Federal requirements. As of March 1994, 46 states have been authorized to implement the RCRA program and may include more stringent requirements in their authorized RCRA programs. In addition, non-RCRA-authorized states (Alaska, Hawaii, Iowa and Wyoming) may have state laws that set out hazardous waste management requirements. A facility should always check with the state when analyzing which requirements apply to their activities.

Assuming the material is a solid waste, the first evaluation to be made is whether it is also considered a hazardous waste. Part 261 of 40 Code of Federal Regulations (CFR) addresses the identification and listing of hazardous waste. The waste generator has the responsibility for determining whether a waste is hazardous, and what classification, if any, may apply to the waste. The generator must examine the regulations and undertake any tests necessary to determine if the wastes generated are hazardous. Waste generators may also use their own knowledge and familiarity with the waste to determine whether it is hazardous. Generators may be subject to enforcement penalties for improperly determining that a waste is not hazardous.

Wastes can be classified as hazardous either because they are listed by EPA through regulation and appear in the 40 CFR Part 261 or because they exhibit certain characteristics. Listed wastes are specifically named, e.g., discarded commercial toluene, spent non-halogenated solvents. Characteristic wastes are defined as hazardous if they "fail" a characteristic test, such as the RCRA test for ignitability.

There are four separate lists of hazardous wastes in 40 CFR 261. If any of the wastes from a printing facility is on any of these lists, the facility is subject to regulation under RCRA. The listing is often defined by industrial processes, but all wastes are listed because they contain particular chemical constituents (these constituents are listed in Appendix VII to Part 261). Section 261.31 lists wastes from non-specific sources and includes wastes generated by industrial processes that may occur in several different industries; the codes for such wastes always begin with the letter "F." The second category of listed wastes (40 CFR 261.32) includes hazardous wastes from specific sources; these wastes have codes that begin with the letter "K." The remaining lists (40 CFR 261.33) cover commercial chemical products that have been or are intended to be discarded; these have two letter designations, "P" and "U." Waste codes beginning with "P" are considered acutely hazardous, while those beginning with "U" are simply considered hazardous. Listed wastes from chemicals that are commonly used in the lithographic blanket washes are shown in Table 2-7. While these exhibits are intended to be as comprehensive as possible, individual facilities may use other chemicals and generate other listed hazardous wastes that are not included in Table 2-7. Facilities may wish to consult the lists at 40 CFR 261.31-261.33.[c]

Generator status defines how to dispose of a listed or characteristic waste. The hazardous waste generator is defined as any person, by site, who creates a hazardous waste or makes a waste subject to RCRA Subtitle C. Generators are divided into three categories:

- Large Quantity Generators - These facilities generate at least 1000 kg (approximately 2200 lbs.) of hazardous waste per month, or greater than 1 kg (2.2 lbs) of acutely hazardous waste[d] per month.

- Small Quantity Generators (SQG) — These facilities generate greater than 100 kg (approx. 220 lbs.) but less than 1000 kg of hazardous waste per month, and up to 1 kg (2.2 lbs) per month of acutely hazardous waste.

- Conditionally exempt small quantity generators (CESQG) — These facilities generate no more than 100 kg (approx. 220 lbs) per month of hazardous waste and up to 1 kg (2.2 lbs) per month of acutely hazardous waste.

Large and small quantity generators must meet many similar requirements. 40 CFR 262 provides that SQGs may accumulate up to 6000 kg of hazardous waste on-site at any one time for up to 180 days without being regulated as a treatment, storage, or disposal (TSD) facility and thereby having to apply for a TSD permit. The provisions of 40 CFR 262.34 (f) allow SQGs to store waste on-site for 270 days without having to apply for TSD status provided the waste must be transported over 200 miles. Large quantity generators have only a 90-day window to ship wastes off-site without needing a RCRA TSD permit. Keep in mind that most provisions of 40 CFR 264

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[c] *Lists of the "F, P, K and U" hazardous wastes can also be obtained by calling the EPA RCRA/Superfund/EPCRA Hotline at (800) 424-9346.*

[d] *The provisions regarding acutely hazardous waste are not likely to affect printers. Acutely hazardous waste includes certain "F" listed wastes that do not apply to printers, and "P" listed wastes, none of which were identified as in use in the commercial lithographic industry. (See 40 CFR 261.31-33 for more information).*

and 265 (for hazardous waste treatment, storage and disposal facilities) do not apply to generators who send their wastes off-site within the 90- or 180-day window, whichever is applicable.

Hazardous waste generators that do not meet the conditions for conditionally exempt small quantity generators must (among other requirements such as record keeping and reporting):

- Obtain a generator identification number;
- Store and ship hazardous waste in suitable containers or tanks (for storage only);
- Manifest the waste properly;
- Maintain copies of the manifest, a shipment log covering all hazardous waste shipments, and test records;
- Comply with applicable land disposal restriction requirements; and
- Report releases or threats of releases of hazardous waste.

## 2.6 SAFETY HAZARD BY FORMULATION

Table 2-8 contains Safety Hazard Factors for the 36 blanket wash formulations and the baseline used in the lithography industry. There are four Safety Hazard Factors addressed in this table: reactivity, flammability, ignitability, and corrosivity. As was described in Section 2.2 Chemical Information for the individual chemicals used in the blanket wash formulations, they were derived as follows.

Where applicable, the reactivity and flammability values were extracted directly from section one of the blanket wash formulation's Material Safety Data Sheets (MSDSs). This section contains the National Fire Protection Association (NFPA) values on both reactivity and flammability. For reactivity, NFPA ranks materials on a scale of 0 through 4:

0 - materials that are normally stable, even under fire exposure conditions, and that do not react with water; normal fire fighting procedures may be used.

1 - materials that are normally stable, but may become unstable at elevated temperatures and pressures and materials that will react with water with some release of energy, but not violently; fires involving these materials should be approached with caution.

2 - materials that are normally unstable and readily undergo violent chemical change, but are not capable of detonation; this includes materials that can rapidly release energy, materials that can undergo violent chemical changes at high temperatures and pressures, and materials that react violently with water. In advanced or massive fires involving these materials, fire fighting should be done from a safe distance of from a protected location.

3 - materials that, in themselves, are capable of detonation, explosive decomposition, or explosive reaction, but require a strong initiating source or heating under confinement; fires involving these materials should be fought from a protected location.

4 - materials that, in themselves, are readily capable of detonation, explosive decomposition, or explosive reaction at normal temperatures and pressures. If a

material having this Reactivity Hazard Rating is involved in a fire, the area should be immediately evacuated.

For flammability, NFPA ranks materials also on a scale of 0 through 4:

0 - any material that will not burn.

1 - materials that must be preheated before ignition will occur and whose flash point exceeds 200°F (93.4°C), as well as most ordinary combustible materials.

2 - materials that must be moderately heated before ignition will occur and that readily give off ignitible vapors.

3 - Flammable liquids and materials that can be easily ignited under almost all normal temperature conditions. Water may be ineffective in controlling or extinguishing fires in such materials.

4 - includes flammable gases, pyrophoric liquids, and flammable liquids. The preferred method of fire attack is to stop the flow of material or to protect exposures while allowing the fire to burn itself out.

For formulations whose MSDs did not contain NFPA rankings, no reactivity or flammability values were assigned. However, please note the following exceptions. For Blanket Wash Formulation #19, NFPA reactivity and flammability values for a major chemical constituent, dipropylene glycol butyl ether, have been included in the table. In addition, for Blanket Wash Formulations #32, #36, and #37, a reactivity designation of "Y" has been given. Based on product composition, it has been determined that these blanket wash formulations are reactive, though no NFPA value has been listed in their MSDSs.

For ignitability, the formulations have been classified as either ignitable, "Y" or not ignitable, "N". Ignitability has been determined based on the flash point of the formulation, as outlined in 40 CFR (Protection of Environment, RCRA), Part 261, Identification and Listing of Hazardous Waste, §261.21, Characteristic of Ignitability. Under this standard, a chemical is considered ignitable if it "is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume and has a flash point less than 60°C (140°F) as determined by a Pensky-Martens Closed Cup Tester...a Setaflash Closed Cup Tester...or an equivalent test method." The flash points for these formulations have been determined by the Graphic Arts Technical Foundation, an independent testing laboratory.

For corrosivity, the formulations have been classified as either corrosive, "Y" or not corrosive, "N". Corrosivity for these product formulations has been determined based on the pH of the product as outlined in 40 CFR (Protection of Environment, RCRA), Part 261, Identification and Listing of Hazardous Waste, §261.22, Characteristic of Corrosivity. According to this standard, a chemical is corrosive if it "is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5." As with the flash points, the pH of the various blanket wash formulations have been determined by the Graphic Arts Technical Foundation.

**Table 2-8. Safety Hazard Factors for Blanket Wash Formulations [1]**

| Formulation Number | Reactivity | Flammability | Ignitability | Corrosivity |
|---|---|---|---|---|
| 1 | 0 | 0 | N | N |
| 3 | | | Y | N |
| 4 | | | Y | N |
| 5 | | | Y | N |
| 6 | | | N | N |
| 7 | 0 | 2 | N | N |
| 8 | | | Y | N |
| 9 | | | N | N |
| 10 | | | N | N |
| 11 | | | N | N |
| 12 | | | Y | N |
| 14 | | | N | N |
| 16 | 0 | 2 | N | N |
| 17 | | | N | N |
| 18 | | | N | N |
| 19 | 0[2] | 2[2] | N | N |
| 20 | | | N | N |
| 21 | | | Y | N |
| 22 | | | N | N |
| 23 | | | Y | N |
| 24 | | | Y | N |
| 25 | | | N | N |
| 26 | | | N | N |
| 27 | 0 | 2 | N | N |
| 28 | 0 | 2 | Y | N |
| 29 | | | N | N |
| 30 | | | Y | N |
| 31 | | | Y | N |
| 32 | Y | | N | N |
| 33 | | | Y | N |
| 34 | | | Y | N |
| 35 | | | Y | N |
| 36 | Y | | N | N |
| 37 | Y | | Y | N |
| 38 | | | N | N |

| Formulation Number | Reactivity | Flammability | Ignitability | Corrosivity |
|---|---|---|---|---|
| 39 | | | N | N |
| 40 | | | N | N |

[1]A blank space in this table indicates that there was not enough information available to develop a Safety Hazard Factor ranking.
[2]Reactivity and flammability data values are for dipropylene glycol butoxy ether.

## References

1. The Hazardous Substances Data Bank (HSDB), developed and maintained by: The National Library of Medicine, Washington, D.C.

2. The Physical/Chemical Property Database (PHYSPROP) and the Environmental Fate Data Base (EFDB), both of which were developed and maintained by: Syracuse Research Corp. (SRC), Environmental Science Center, Merrill Lane, Syracuse, New York.

3. Budavari, S., ed. 1989. The Merck Index, 11th ed. Merck & Co., Inc., Rahway, NJ.

4. Lewis, R.J., ed. 1993. Hawley's Condensed Chemical Dictionary, 12th ed. Van Nostrand Reinhold Co., New York.

5. Lyman, W.J., et al. 1990. Handbook of Chemical Property Estimation Methods.

6. Beilstein on-line data base. Undated.

7. Aldrich Chemical Company, Inc. 1990. Catalog Handbook of Fine Chemicals.

8. U.S. Department of Health and Human Service. 1985. CHEMLINE. Chemical Dictionary Online.

9. Chemical Abstracts Systems. 1994.

10. Buckingham, J. 1982. Dictionary of Organic Compounds.

11. CRC. 1993. Handbook of Chemistry and Physics.

12. Sax, N.I., and R.J. Lewis. 1987. Hazardous Chemicals Desk Reference.

13. U.S. EPA. Integrated Risk Information System (IRIS). 1995.

14. Perry's Chemical Engineering Handbook. 1984.

15. Ullman, F. 1985. Ullman's Encyclopedia of Industrial Chemistry.

16. Verschueren, K. 1977. Handbook of Environmental Data on Organic Chemicals.